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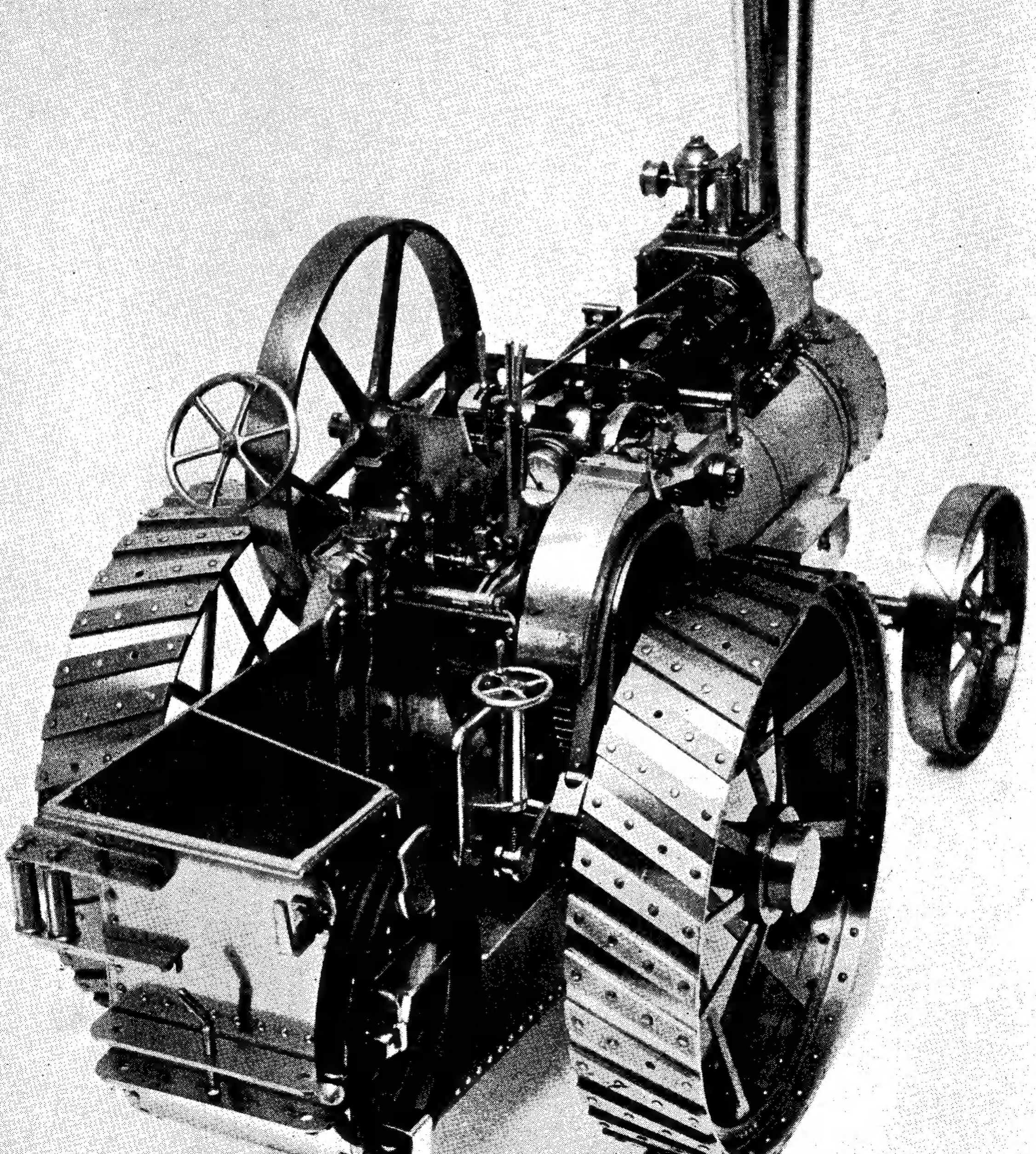
THE MODEL ENGINEER



The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

22ND MAY 1952 VOL. 106 NO. 2661

SMOKE RINGS

Malden S.M.E. Gala

● THE MALDEN and District Society of Model Engineers will be holding the usual Whitsun fete and gala at the ground at Thames Ditton, lasting over the three days, Saturday, May 31st, Sunday, June 1st and Monday, June 2nd. There will be a greater number of sideshows, which, however, will not be in operation on the Sunday. The exhibition will be enlarged by the inclusion of the competition section for the Malden Medal of Merit and the Malden Championship Cup. Part of the new headquarters building, now almost complete, will be used for large cinema shows, and, of course, the society's 880-ft. circular track will be in continuous operation. Demonstrations of model aircraft flying, race cars, etc., will also be given, and refreshments will be available.

The society is hoping to see many of its friends from other clubs. The hon. social secretary, Mr. S. W. Stevens-Stratten, 3, Coombe Gardens, New Malden, Surrey, will be pleased to forward further information.

A Visitor from Australia

● WE HAVE been very pleased to welcome Mr. V. H. Messer, whose name will be known to regular readers, because of his occasional contributions to our pages. Mr. Messer will be in England during the next three months, and is hoping to see something of model engineering activities in this country. We have assured him that he will be welcomed warmly by any society that he is able to visit. He is primarily a steam locomotive enthusiast and has built no fewer than eleven $2\frac{1}{2}$-in. gauge locomotives, usually something a little out of the ordinary, and most of them have won high awards at exhibitions in different parts of the world.

As hon. secretary of the South Australia Society of Model Engineers, Mr. Messer is in close touch with our confreres in those parts, from whom he brings warmest greetings to all model engineers here. If the secretary of any society round London would care to get into touch direct with Mr. Messer, his address is 210, Adamsrill Road, Sydenham, London, S.E.26.

Stockport's Second Exhibition

● THE STOCKPORT and District Society of Model Engineers held their second, non-competitive, exhibition recently, and the Mayor of Stockport, accompanied by the Lady Mayoress, performed the opening ceremony. One feature of the opening was that the ceremonial speeches were recorded on Mr. M. C. Gerrard's wire recorder and within a few minutes of the end of the ceremony, the Mayor and Mayoress were listening intently to the Chairman's and Mayor's remarks. During the course of the exhibition, visitors were invited to make recordings, so that by the end of the show that very fine wire held many interesting comments.

Mr. H. Slack's model of the Derbyshire galloper roundabout was the highlight of the show

and is undoubtedly one of the finest examples of real craftsmanship. It is only during erection or dismantling that one realises the correctness and completeness of detail in all parts.

Amongst the locomotive exhibits Mr. W. Tucker's N.E.R. Atlantic, in $3\frac{1}{2}$-in. gauge, was a beautiful example of locomotive modelling., Several other locomotives, finished and unfinished were evidence of the locomotive's popularity. A short length of $3\frac{1}{2}$-in. gauge track in the hall was nearly always working to capacity.

In the ship models section were many fine examples, amongst them Mr. V. Briggs's steam tug *Alpha*, Mr. A. Hahn's unfinished cabin cruiser, and Mr. C. Ledwidge's 36-in. cargo boat. Mr. A. Law's radio-control gear for his *Javelin* was interesting to watch, when operated, although this was by direct connection and not by actual radio. Mr. C. Lindsey operated his vibrating reed system of radio-control, and in this an earphone was used to indicate the three different tuned circuits.

In the general section Mr. H. G. Winton's 2-in. scale 8 h.p. traction engine, as yet unfinished, was much admired. A steam winding engine, by Mr. A. Mordue, was a type of model not often seen. The doll's house by Mr. R. Fairhurst was probably of most interest to the ladies. Mr. A. Law exhibited the episcope he made for the society and which has proved its worth at the meetings. To remind the society that once trams ran in Stockport, Mr. A. J. Brooke, of Elland, Yorks, sent a model of a Stockport low-bridge type of tram. Several models were run on air, amongst them a 5 h.p. type of Crossley gas engine and a 1-in. scale Massey steam hammer, the latter soon reduced a pencil to splinters when operated!

In the tool section good work was evident in various tools and appliances made by members.

Working to Scale "In Excelsis"

● FOLLOWING UP our recent note upon the subject of "Working to Scale," we learn of one enthusiast who has tackled the problem in a thoroughly practical, if somewhat unorthodox, manner. He is Mr. Sidney Stubbs, of the Manchester Model Railway Society, who is well known in the model railway hobby as a real stickler for exact scale reproduction of any prototype in miniature. To ensure that his 4-mm. scale models of locomotives shall be right in all essential visible details, he has made himself a micrometer by means of which he can, when necessary, measure down to scale sixty-fourths of an inch in 4-mm. to the foot scale!

This would seem to put to shame people who get into difficulties when working to much larger scales, but we do not think that the necessity for working to the nearest 1/64 in. in 4-mm. scale can occur very frequently. We are actually in possession of a special steel rule on which a scale of 10 mm. to the foot is beautifully engraved; it includes a diagonal scale by means of which measurements can be taken down to the nearest scale eighth of an inch. That, in 10-mm. scale, is quite a fine limit of accuracy and sufficient for all practical purposes, when making either drawings or models. We do not intend that remark to disparage Mr. Stubbs of Manchester; we have seen a 4-mm. scale L.B.S.C.R. "Terrier" tank locomotive which he has built, and we have nothing but praise, not only for its perfection of detail and appearance but also for the methods which made such a perfect piece of work possible.

Another G.N.R. Centenary

● THIS YEAR, the direct route from London (Kings Cross) to York will be 100 years old, and preparations are in hand to mark the occasions with some kind of celebration. Mr. S. L. Redshaw, chairman of the Grantham Society of Model Engineers, informs us that his society will most probably be holding a "Great Northern Railway Exhibition" during the week July 28th to August 2nd, to celebrate the hundredth anniversary of the opening of the "Towns Line," that is the Werrington Junction to Retford line. Scale models of Great Northern Railway locomotives and rolling stock, preferably in their original liveries, will be needed; so if any reader or club secretary knows of such items which would be suitable, or of any G.N.R. relics, we are sure that the Grantham Society would be very glad to hear from him. Mr. Redshaw's address is: 191, Harrowby Lane, Grantham, Lincs.

Royal Society of Arts Prizes

● UNDER THE Thomas Gray Memorial Trust, the objects of which are "the advancement of the science of navigation and the scientific and educational interests of the British Mercantile Marine," the Council of the Royal Society of Arts is offering two prizes in 1952.

The first is a prize of £50 for an essay by a professional seafarer of the British Merchant Navy, of British nationality, who is serving afloat or, if now ashore, has been regularly serving afloat no longer ago than January 1st, 1950. The subject of the essay is: "The Future of the Cargo Liner, with particular reference to the following: general construction, tonnage, capacity, power unit, speed, general economy and complement."

The essay should not exceed 7,500 words in length, and should reach the Secretary of the Royal Society of Arts, John Adam Street, Adelphi, London, W.C.2, not later than December 31st, 1952. It should be typed in English, and must be submitted under a pseudonym, accompanied by a sealed envelope enclosing the author's name and address, which must on no account be written on the essay. A breach of this regulation will result in disqualification.

The second prize, also of £50, is offered to a member of the British Merchant Navy for a deed, brought to the notice of the Council, which, in the opinion of the judges, is of outstanding professional merit. The period to be covered by the offer will be the year ending September 30th, 1952, and the judges will proceed to consider their decision on or after January 1st, 1953. Deeds of a character worthy to be considered for this offer may be brought to the notice of the Council by any person not later than December 31st, 1952. They must be endorsed by a recognised authority or responsible person able to testify to the deed.

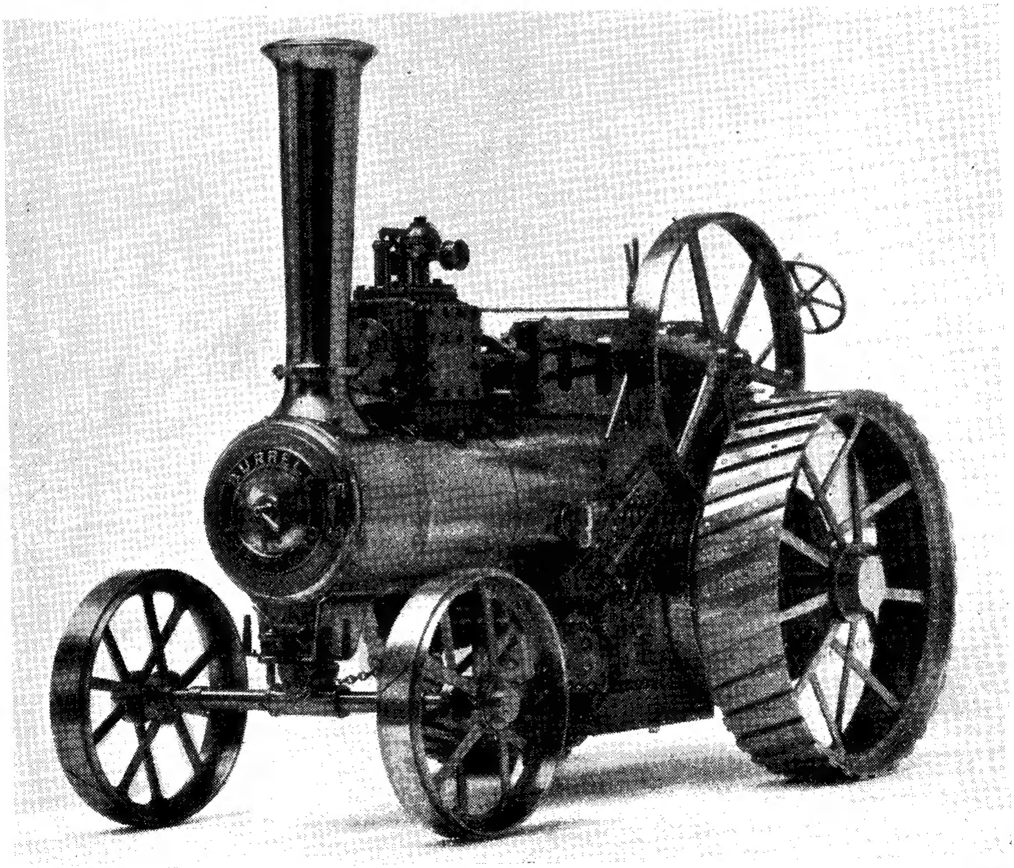
A $1\frac{1}{2}$-in. Scale "Burrell" Traction Engine

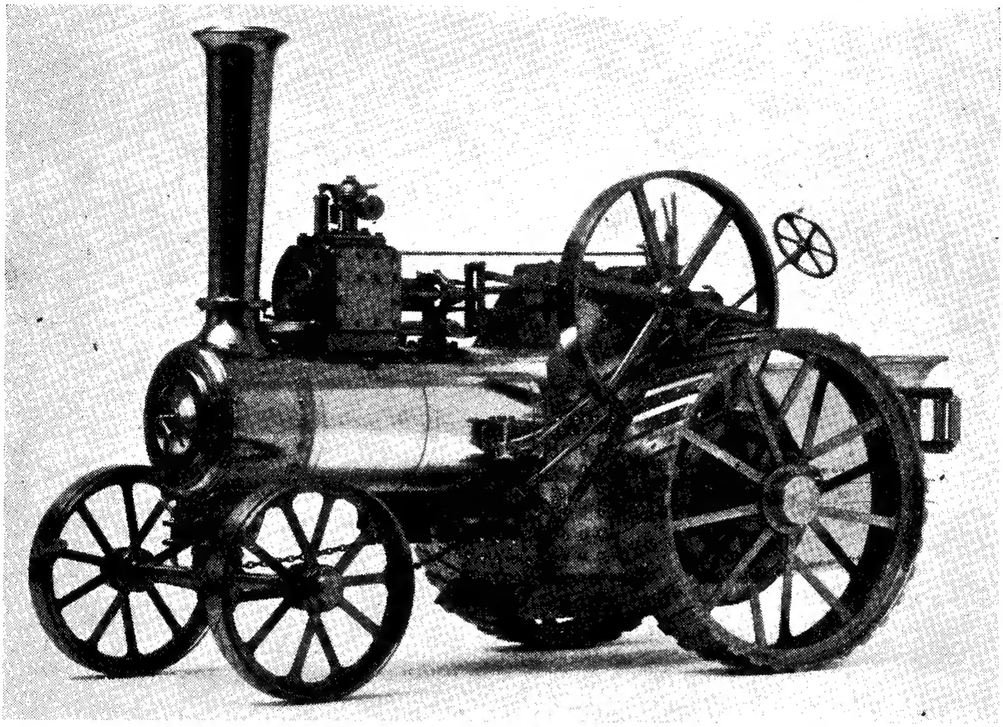
A first attempt by A. Newman

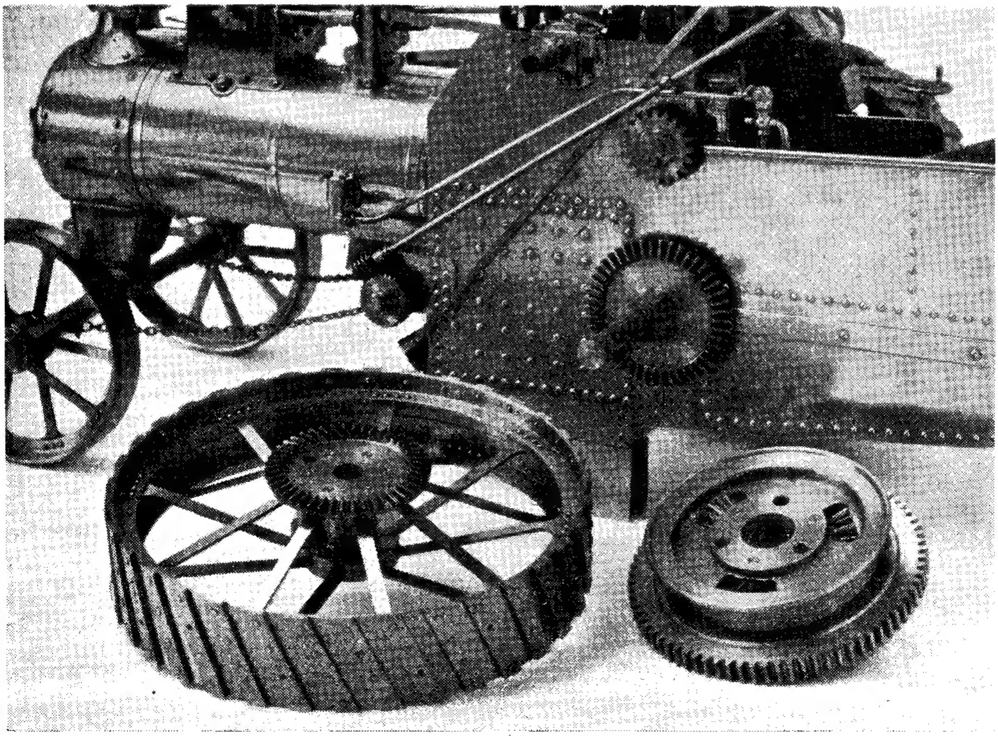
(Photographs by courtesy of Bassett-Lowke, Ltd.)

AT a local model exhibition a year or so ago, I was so fascinated by two traction engines which were turning over smoothly on compressed-air, that I decided to build a model myself. I possessed a lathe, but lacked the courage to start on anything in the nature of a working model. However, guided by my enthusiasm to own one of these delightful engines, I obtained from Bassett-Lowke Ltd. a set of drawings for a $1\frac{1}{2}$-in. scale "Burrell" single cylinder traction engine. It was quite a simple design of an engine in use fifty years ago. The prints being prepared by an authentic designer were true to scale and gave plenty of detail. I also had the good fortune to find an old "Burrell" engine; although it was of a later type to the one I proposed to build, many of the parts were the same. The rims of the hind wheels were made up from two tee-rings, held together by the strakes. I decided to follow this practice and after a good deal of thought a start was made on the wheels.

The local iron works were able to supply four mild-steel blanks, 8 in. diameter by 1 in. thick. From this material I turned up the four tee-rings for the rear wheels, two front wheel rims, winding-drum and flywheel. The spokes were set out in the flywheel whilst it was still in the lathe and then put on one side until I was feeling energetic enough to drill, hacksaw and file it to shape. The hubs for the hind wheels were made from two pieces of $2\frac{1}{2}$ in. diameter mild-steel $1\frac{1}{2}$ in. long, turned to the shape of a bobbin with two large flanges and a spigot at

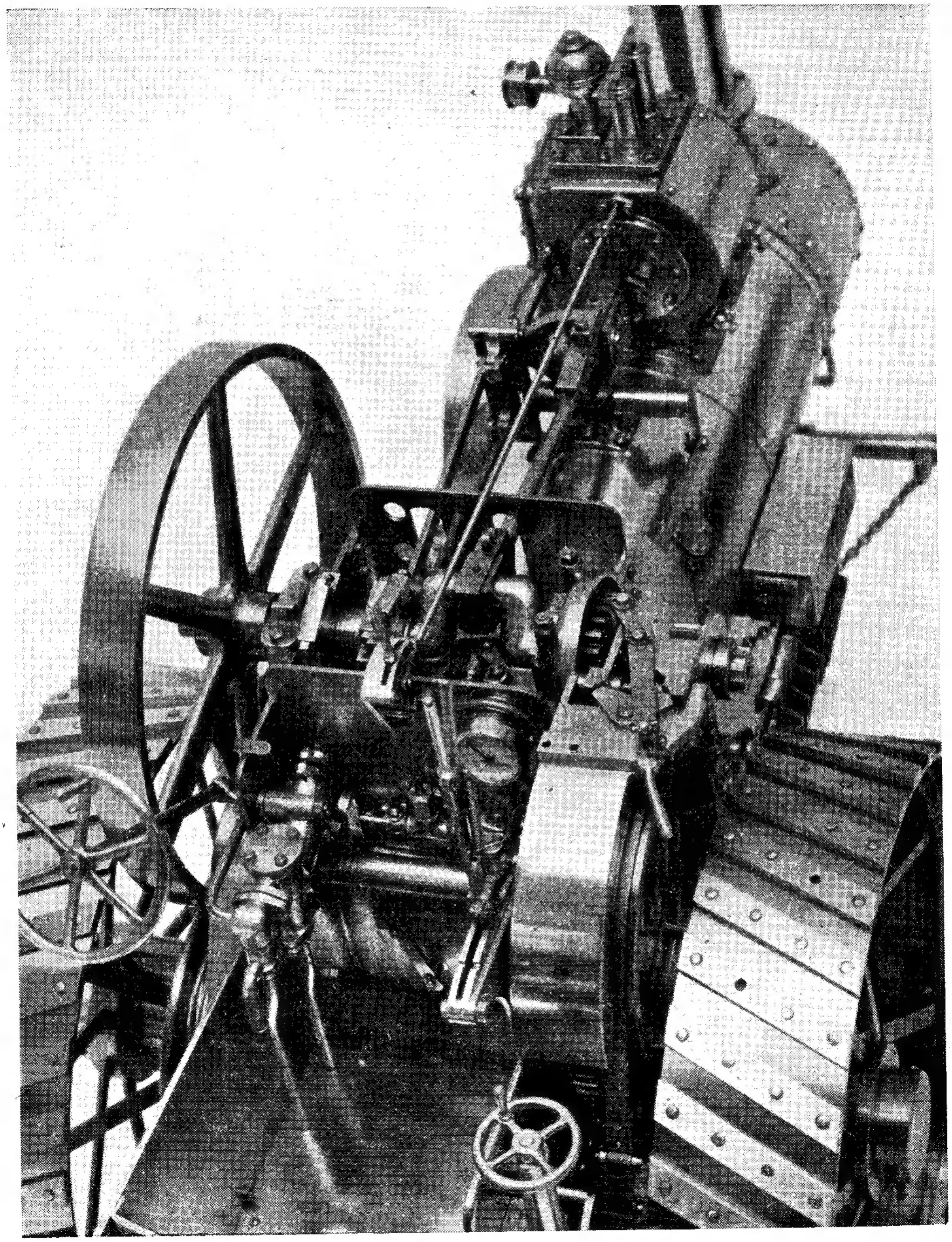


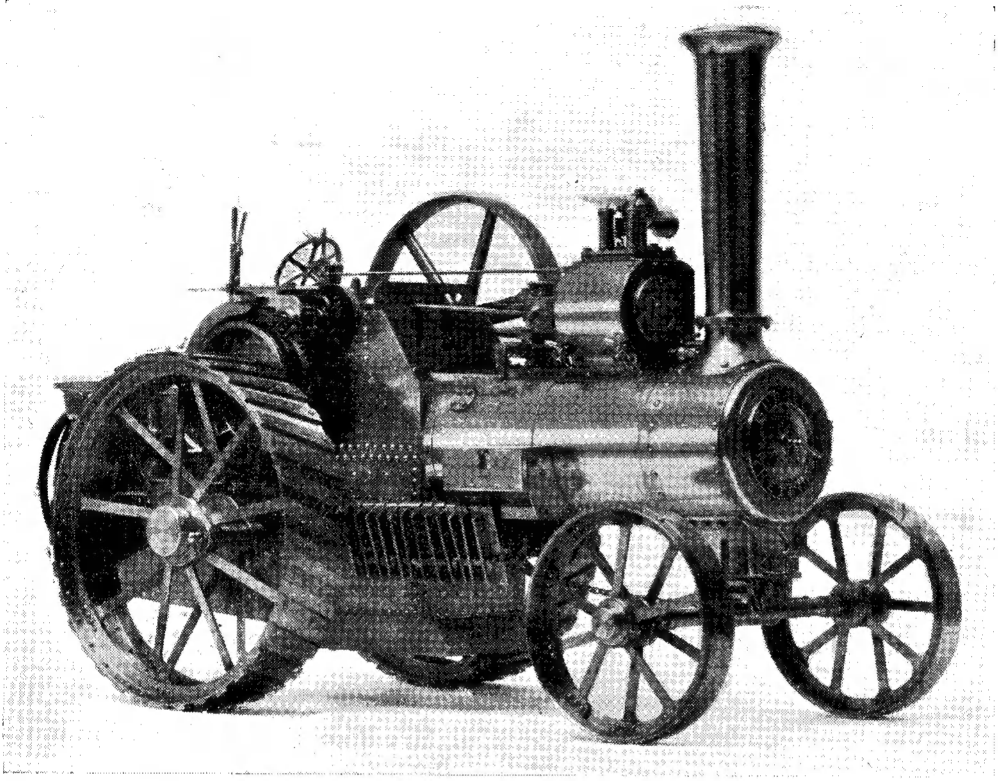




both ends, these being screwed with a fine thread for the plates which clamped the spokes in position. A pear-shaped template made from 16-gauge material was inserted between the flanges and the plates, then the hub filed up to shape, two bronze bushes being fitted to each hub.

I cut four discs from 16-gauge steel to make the hind wheel spokes, two sizes of discs being necessary, as the rims were not central over the hubs. It is also worth while at this stage, to point out that three spokes in each wheel were longer, owing to the pear-shaped hub. By making a sketch of the wheel and bending some pieces of 16-gauge wire to represent the indivi-





The pad on the off-side of the boiler was for a check valve, so that the boiler could be fed by hand pump. This, however, was found to be unnecessary.

dual spokes, I was able to determine the exact measurements. Two discs were riveted together, set up in the lathe and turned to the diameter of the longest spoke, then after making two cuts 1 in. deep, with the hacksaw, a portion was bent back slightly over the faceplate and the discs turned to the size of the remaining spokes. It was an easy matter to set these out by using a change-wheel as a dividing head and marking across the discs with a pointed tool. While still in the lathe, the centre was bored out to fit the hub. After a little exercise with a hacksaw, a file and some very careful bending, the spokes took on the appearance of four large spiders and were ready for drilling.

The next step was riveting. Approximately 200 mild-steel rivets per wheel were used, but the problem was how to do it without too much noise. I overcame this, by replacing the hardened jaws of the bench vice by two pieces of mild-steel 1 in. square and 8 in. long, which extended over the vice about 2 in. at each end. These were drilled at the ends to take the various shapes of rivet sets, which I made from $\frac{5}{16}$-in. silver-steel. A good deal of experimenting was necessary to get these tools just right, but once this was achieved the actual riveting operation was performed by just screwing up the vice.

There is just one more point I would emphasise before we leave the wheels; when the strakes were fixed, the rivets were not cleaned off flush. I understand this was full-size practice and helped the engine to get a good grip when being demonstrated, although I have no doubt the old flint roads very soon wore them down.

I had two pre-war "Woolworth" hand-drills with nicely cut bevel gears, which were just the right size for the differential. The design called for a spigot on one of the bevels to support the winding-drum; this was overcome by boring out one of the gears and screwing it with a fine thread on to a suitable piece of mild-steel. After locking it in position, the whole thing was turned up to the drawing. The winding-drum which also houses the pinions was bushed with bronze to avoid two pieces of mild-steel working together.

Castings were not yet available, therefore I proceeded with the steel formers to make the firebox ends, the boiler throat plate and the front end-plate. Paper patterns were cut of all the various pieces of copper required. This enabled me to cut them from the sheet with the minimum of waste. Copper, 16-gauge, was used except for the tube plates, which were 14-gauge.

The hornplates were squared up and riveted together with a piece of card between them; this made it possible for me to machine the cut-outs for the crankshaft bearings at one setting. The

hornplates were mounted on a large angle-plate attached to the slide-rest and bored out 1 in., as this was the correct size for the left-hand bearing. Then the flycutter was set out in easy stages to cut $1\frac{3}{4}$ in. for the right-hand bearing, and fed through until it cut into the piece of card.

I had to hold up the boring for the second shaft and rear axle bearings until I had decided upon the gears I was going to use. However, I found two lathe change wheels of 20 d.p. which were the correct size in diameter for the fast and slow gears, having 70 and 80 teeth respectively. The pinions with 25 and 15 teeth were cut from mild-steel. For the last drive, two more lathe change wheels of 16-d.p. were obtained from an advertiser in THE MODEL ENGINEER. Before any of the gears were altered, I turned up two suitable bushes, with a large flange on them, these were soft-soldered to the hornplates and adjusted until the gears were in correct mesh. A drill was passed through the bushes to drill the holes for the second shaft and rear axle bearings.

The boiler was close-riveted with 3/32 in. rivets, all seams being well tinned beforehand. The whole boiler was warmed up and tinned all over the inside before inserting the fire-box which, of course, was silver-soldered. Eleven $\frac{7}{16}$ in. tubes were fitted and the 5-B.A. copper boiler stays were screwed in at $\frac{1}{2}$ in. centres. Finally, the boiler was tested to 125 lb. per sq. in. and showed no signs of distortion or leak.

The tender was made from 20-gauge brass sheet riveted up with $\frac{1}{16}$-in. rivets to $\frac{1}{4}$ in. angle and caulked with soft solder.

A bent-type crankshaft was fitted on these old "Burrell" engines, but as the bends had to be so short I decided to cut the crank out and shape it up from $\frac{5}{8}$ in. flat mild-steel. After it was turned, the splines were cut by the "planing" method, the shaft being held between the centres and supported with a fixed steady. A suitably shaped tool was clamped in the toolpost and the saddle wound backwards and forwards. Only very light cuts were taken, so that with the tailstock taking the thrust, I avoided undue strain on the crank.

The cast-iron cylinder $\frac{7}{8}$-in. bore by $1\frac{1}{8}$-in. stroke was a very interesting piece of work. As in the full-size model, it was cast complete with the mounting saddle and valve-chests. The port-face and also the ports were carefully machined in the lathe, with an end-milling cutter. Great care was necessary with some of the drilling which, because I did not possess a drilling machine, was also done in the lathe, with the cylinder clamped to the vertical-slide. The casting was drilled at the base and tapped to take the blower valve. Stainless-steel was used for the cylinder end covers, valve-chest cover, piston-rod, etc., and the screws were 7 and 10 B.A. throughout. A displacement lubricator made to the shape of the enclosed-type governor was fitted, the pulley acting as the drain plug.

A water pump situated in the tender on the left-hand side was driven direct from an eccentric on the crankshaft.

The engine steams remarkably well. When the first trials were in progress, my 8-year old son invited his friend to bring round a four-wheeled trolley. This was not a very easy running affair, and when they sat in the contrivance the small wheels sank into the rough grass. However, in spite of the handicap, the engine pulled away quite easily.

In conclusion, I should like to thank the members of the Oxford M.E.S. for their advice and information, which made the construction of this model so interesting.

For the Bookshelf

Chronicles of a Country Works, by Ronald H. Clark, A.M.I.Mech.E. (London: Percival Marshall & Co. Ltd.) 305 pages, size 7 in. by 10 in. Illustrated. Price £3 3s. net.

One of the best-known names in the history and development of the road locomotive is that of the firm of Charles Burrell & Sons Ltd., of Thetford, Norfolk, a name that was respected and familiar in almost every country of the world. This was mainly because of the fine quality of the workmanship which was characteristic of Burrell products, outstanding even in a period during which fine workmanship was the usual feature of all engineering products. And this was not only a matter of external appearance and finish, for Burrell engines were well-built throughout and based on thoroughly sound design; further, the fact that the firm existed for nearly 160 years, during which the business was carried on largely as a family concern, provides the chief clue to the universal esteem it enjoyed.

The history of a firm of this nature is always worth setting on record and preserving for posterity; but such a task demands the right historian, in that he should possess a thorough understanding and knowledge of the products of the firm, combined with the instinct for selecting the right material from the information at his disposal. These *Chronicles of a Country Works* are a case in point; their author has obviously enjoyed his work involving a prodigious amount of research, a careful selection of his material and the setting down of a readable and well-balanced record. Moreover, he has most successfully resisted what must have been an almost irresistible temptation to be merely nostalgic. His story is a straightforward account of the rise and demise of a world-famous business, and it includes detailed descriptions of most of the different types of road and agricultural engines and equipment constructed by the firm.

The illustrations are all of great interest and value; many of them are detail drawings of speciality products. There are some general arrangement drawings of different types of Burrell tractions, scenic showmans' engines and others, while the selection of photographic reproductions is highly appropriate and historically valuable. In short, the book is a "must" for the enthusiast, the model maker and the antiquarian alike.

"L.B.S.C.'s" Lobby Chat

Balance Weights in Locomotive Wheels

On page 420 of the March 27th issue, there was a dissertation on balance weights in locomotive wheels, accompanied by a drawing showing part of the "works" of a coupled engine. The balance weight in the leading wheel is shown on the same side of the wheel as the crankpin. Several readers have called attention to this, and have asked if it is correct, saying that they have never seen nor heard of a locomotive with the balance weights in a *non-driving* wheel, on the same side as the crankpin. Neither has your humble servant; the drawing is incorrect. The writer of the article did not make the drawing; it was extracted from the book *Locomotive Valves and Valve Gears*, by C. S. Lake and A. Reidinger, and the authors have apparently become a little mixed up in the positions of balance weights in driving and non-driving wheels, so let's see if we can clear up the matter with a little simple analysis.

If you look at the wheels of an *inside cylinder* 4-4-0, such as the *Maid of Kent*, you will notice that the balance weight in the *driving* wheel is on the same side as the crankpin, but offset a little in relation to it. The balance-weight in the *coupled* wheel is much smaller, and on the opposite side to the crankpin, without any offset; just the reverse to the arrangement shown in the drawing referred to above. The reason for the balance weight in the driving wheel being set in that position, is because the big crank on the axle, is exactly opposite to the little crank in the wheel, which carries the coupling-rod. As the little outside crank isn't heavy enough to balance its big inside relation, a weight, naturally, has to be added to make up the deficit; and this must, of course, be on the same side as the outside crankpin, otherwise it wouldn't balance the inside crank, to which it is opposite—or rather, nearly opposite. It is set a little off centre, so that it can balance part of the inside connecting-rod as well; some of these are of exceedingly "Bill Massive" proportions, as they undergo terrific stresses at times, for example when the engine is just starting away with a heavy load on a stiff bank.

Rough on the Axleboxes!

The idea of using the weight of the outside crank and part of the coupling-rod, to partly balance the inside crank (I just love splitting infinitives!) seems the most natural thing to do, and most of the old-time locomotive designers did it; but there is the usual wasp in the jampot. The whole of the rocking stress has to be taken by the axlebox, as under the above conditions it acts as the fulcrum of a lever of the first order. Unless it is a very good fit in the horns, it will kick up an infernal clatter as the big-end alternately pulls and pushes it against the resistance of the coupling-rod on the opposite centre. Some locomotive engineers recognised this, and put the inside cranks on the same centres as the outside cranks. Billy Stroudley was one; another Billy, Dean of that ilk, had the same idea. If you take a look at any picture of Stroudley's engines, you'll notice that the balance weights in all wheels are opposite to the coupling-rod; the same can be seen on the G.W.R. *Atbaras*. S. D. Holden, son of Jimmy of *Petrolea* fame, did the same thing on the 1500 class 4-6-0's of the Great Eastern; so did one or two others.

With this arrangement, the pull and thrust of the connecting-rods acted in unison instead of opposition to the coupling-rods, in a manner of speaking, and there were no racking strains on the axleboxes. We had no trouble with them on the L.B. & S.C. Railway, at any rate, on any Stroudley engine. Of course, the usual moan was raised, because the balance weights had to be big enough to balance both the inside and outside cranks, and part of the coupling-rods; and it was stated that this increased the "hammer-blow" of the balance-weight on the rails, at each revolution. This was decidedly unacceptable to the Brighton enginemen; they would not have it that engines which rode as steadily as the Stroudley engines, could hammer at the rails and cause damage. I can personally vouch for their steady riding. On more than one occasion, a driver has been known to inadvertently leave an oil feeder on the running-board at the smokebox end, and it has remained there during a journey from London to the South Coast, or vice versa.

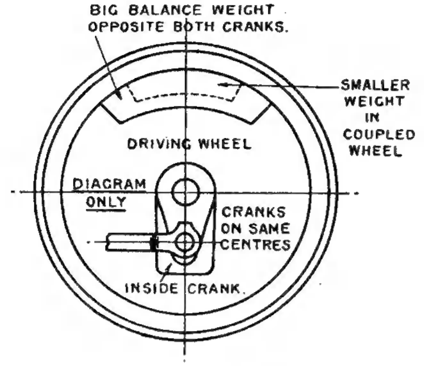
This "excessive hammer-blow" theory was also very effectively scotched by the late Mr. E. L. Ahrons, an authority on locomotives who certainly knew what he was talking or writing about. (I love ending sentences with prepositions; they make nobby tail lamps.) In his book on *Developments in Locomotive Design*, he gives the "scientific" explanation; but anybody who has seen a pair of big driving wheels with heavy balance weights in them, spinning in spring-mounted bearings at a speed equal to 90 m.p.h. with no appreciable movement of the bearings, has no need of further explanation. Readers of these notes who have visited Swindon Works, have probably seen the above for themselves, and learned more from it than by reading all the technical books ever written. "Seeing is believing" still holds good!

Staggered Balance Weights

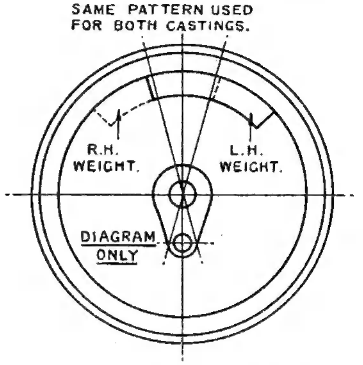
When old man Billy quit this earth and joined the Great Astral Railway, and Bob Billinton took over on the L.B. & S.C.R., the enginemen soon found the difference. Bob's engines were

nothing nearly as steady as Billy's and it was at once noted that the cranks and coupling-rod pins were opposite, with the driving balance weights on the same side as the crankpins. When axleboxes began to rattle, they drew their own conclusions. Anyway, you couldn't leave an oil feeder on the running-board, and find it still there at the end of the trip ; and it wasn't exactly an unknown occurrence for a tea-bottle to jump clean out of the tray over the firehole door—I DO know that much!

Getting back to present times, while the drawing referred to at the beginning of this lobby chat is all wrong, there is a modicum of truth in the little bit of third programme underneath it. For example, consider the balance-weights in the coupled wheels of *Britannia*. These are offset, in relation to the crankpin ; but as the wheels are exactly the same on both sides of the engine —that is, the same wheel centres are used both as the other is behind, so they balance. The wheels, naturally, are not pressed on the axles with both crankpins on the same centre—I have just shown them thus, for the sake of simple explanation—they are at the usual right angles, but the effect is the same ; with one behind, and one ahead, of the respective crankpins, a perfect balance is obtained. By arranging the weights thus, instead of each weight being exactly opposite to its respective crank, the effect is what the kiddies would call " spread out a bit more."

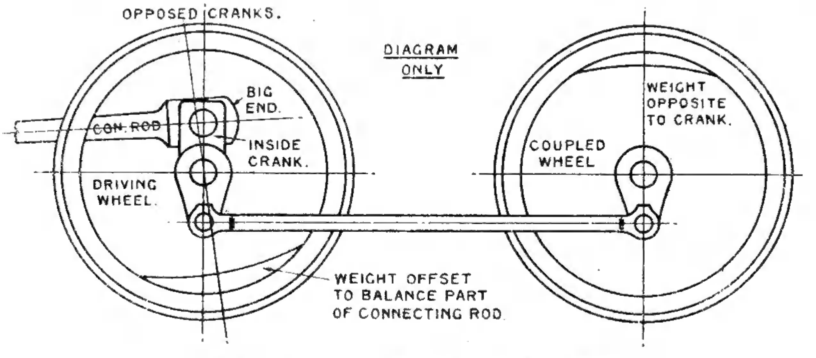


Stroudley balancing



" Britannia " coupled wheels

Incidentally, this has foxed several builders of the little *Britannia* which I am now describing. Our advertisers have supplied four exactly similar castings for the coupled wheels, which is perfectly correct ; and have received a few indignant letters saying that this was all wrong, as the balance weights are all offset to the rear, when the crankpins are on bottom centre. Therefore the balance weights were in the wrong position on two of the wheels. Well, they weren't, as you'll see if you look at both sides of a full-sized *Britannia* class engine. It doesn't matter which side leads, as long as the other follows ; on my own engine, the left side leads, as was shown on the first lot of development drawings that I received from British Railways. Well, I hope the whole business is now completely balanced, so we'll get on to something else.



Balance weights of inside-cylinder 4-4-0

for right- and left-hand sides, the offset on one side is in direct opposition to the offset on the other side, and so the two weights cancel out, in a manner of speaking. If you look at the accompanying diagram, you'll see what I mean. This shows the two wheels placed back to back ; the full lined balance weight is in the wheel nearest to you, and the dotted-lined merchant is in the other wheel. The offset on one is the same distance ahead of the vertical centre-line,

Braking Queries

It is now some thirty years since my old *Ayesha* demonstrated to all and sundry, that hauling loads of living passengers with a weeny coal-fired engine was a piece of cake, provided you knew how to build the engine; and at that time, the only small line capable of carrying the load, to the best of my knowledge and belief, was the adjustable "parallel rule" affair belonging to the S.M.E.E., and even that was a bit wibbly-wobbly. Well, times have changed since the memorable evening when the old girl proved that your humble servant was NOT a purveyor of terminological inexactitudes (third programme again!) and wherever one goes at the present time, small passenger-carrying lines can be found. The trouble now is, not to *pull* the load, but to *stop* it! It isn't so important on a permanent continuous line, where there is plenty of room to stop, unless somebody happens to be too close in front; but on a portable straight line, such as some of the clubs use when attending fetes and other public functions, failure to stop at the right place with a load of kiddies, might have serious consequences. Several readers have enquired as to how they might fit continuous brakes to the passenger cars, and operate them from the locomotive or driving car. I have already dealt with this matter in detail, in past issues; but for newcomers' benefit, here is a brief resume.

Type of Brake to Use

The only satisfactory continuous brake for small passenger cars, is the "straight" air brake. The vacuum brake is too slow for a funeral; indeed, in full size, it has helped to cause a few. Many enginemen, and your humble servant, are of the opinion that the Westinghouse quick-acting air brake would have saved Bill Swabey's train when that unfortunate L.M.S. driver was coming down the bank from Tring, early one Sunday morning, and found the road set for the fast-to-slow crossing at Bourne End. The train went into a field, and poor Bill to the enginemen's Valhalla. Whatever those who favour the "wackum" say or do, the fact remains that wherever a quick and safe stop is essential, such as on the London Underground and the Southern Electric, the air-brake reigns supreme; and it is the only kind allowed by law in America, where freight trains are often a mile long. The L.B. & S.C.R. used the air brake, and you can take it from Curly, that it is the only one to "wack 'em"! On weeny rolling-stock, it *would* be possible to use a hydraulic system, similar to the Lockheed brake on my gasoline cart; but there would surely be trouble with leaky hose connections between cars, and loss of fluid, although there would be no necessity to use the glycerine compound. Ordinary oil would do, or even water.

Brief Specification

The brake rigging on the car bogies, could be made in the same way that I recently described for the *Tich* driving car, as far as the brake blocks, hangers, and cross beams are concerned; but instead of the equalising arrangement of levers, all you need is a simple cylinder with a cup-leather piston, between the brake beams. The piston-rod is connected to one beam, and the

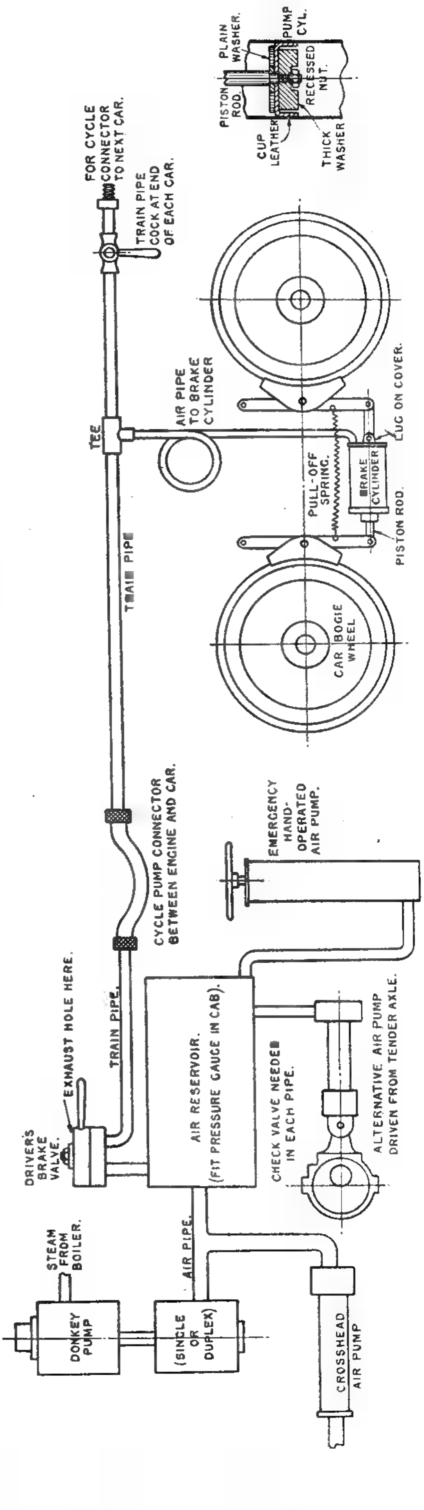


Diagram of simple continuous air brake

cylinder cover to the other. When air is admitted to the cylinder, the piston and rod pushes one beam, and the reaction on the cylinder cover pushes the other in the opposite direction, thus " plonking 'em on " as the enginemen would say. A pipe runs through the train, connection to each cylinder being made by [redacted] bit of pipe with one coil in it, and unions at both ends, tees being inserted in the train pipe at the convenient points. Simple soldered joints would do. Connection between cars, is made by simple cycle-pump connectors, obtainable at any cycle stores, and used as they are purchased, no alterations being needed.

A big air reservoir would be needed under the tender, or [redacted] couple of smaller ones, according to the arrangement of axles. To pump this up, one of the steam donkey pumps, single or duplex, which I have described for boiler feeding, could be used, the water-ram being replaced by a cup-leather piston working in [redacted] cylinder not much smaller in diameter than the steam cylinder. The cup should be filled by [redacted] loose-fitting slice of round rod, to reduce clearance to a minimum, or you won't get enough air pressure. An eccentric-driven pump could be operated also, off one of the tender axles, on the same principle as the G.W.R. crosshead-operated vacuum pumps ; or one of these identical pumps could be used, with the valves reversed, to pump air into the reservoir and train pipe instead of sucking it out. A hand-operated pump could be fitted for emergency use ; the late Bro. Wholesale fitted hand pumps to his air-braked rolling-stock.

All that is needed for a driver's brake valve is [redacted] simple three-way cock, or one of the three-way steam brake valves such as I described for *Doris* and *Pamela*. I might mention here, with advantage, that blueprints of all these blobs and gadgets, and many other things I have described, can now be obtained from the " M.E." offices. You've probably heard of the wag who tried to pull the leg of the old village postmistress. She ran the general store, and put a notice in the window " If you don't see what you want, ask for it." Mr. Cleverdick went in and asked for an elephant. The old lady, without batting an eyelid, said politely " Yes, sir, I can supply, if you'll call back later." The wag, the wind completely knocked out of his sails, and wondering what on earth was going to happen, paid the £2 deposit asked, and agreed to call back later. The old lady promptly telephoned [redacted] friend who owned [redacted] travelling menagerie and was visiting [redacted] nearby town ; told him, with many chuckles, what had happened, and when the wag turned up at the appointed time, there was the elephant outside the store. " You've changed your mind, and don't want it now ? " said the old girl very sweetly. " Well, sir, I'm sorry, but you will have to forfeit your deposit, to recompense me for my trouble, and your cancelled order." And that was that ! Anyway, if you don't see the title of the blueprint you need, in the list issued by " P.M.," just write in. I have two steamer-trunks full of drawings made at different times, and your " want " may be among them. Many of the blobs and gadgets that I have described in these notes, have never been traced and blueprinted, but—to paraphrase an old saw—" it's never too late to make amends " !

Mixed Pickles

To close this lobby chat, here are a few very-much-condensed replies to some recent queries, which may interest all followers of these notes. There really were fairground organs operated by steam direct. They consisted of [redacted] number of whistles, supplied from [redacted] steam boiler, and the valves could be operated either from a manual keyboard, or by [redacted] pegged roller. Over in U.S.A. they were common in days gone by ; they were known as " calliopes." I have heard them play, and prefer the music to [redacted] cinema organ any day.

Somebody called me over the coals, because I don't specify equivalent metric measurements as well as drill numbers, fractions, wire and sheet metal gauge sizes, and so on. If " Bro. Lazy " likes to bestir himself [redacted] wee bit, he will find conversion tables in text books, engineering diaries, and even in some of the kiddies' school books, and can quite easily find out the equivalents for himself, without putting your very-much-harassed humble servant to any further trouble. Reminds me of Weary Willie the tramp, who, when offered [redacted] " fag " said " Just light it and blow the smoke in my face."

A reader, about to lay [redacted] continuous line for [redacted] *Doris*, asks if I have had any experience of aluminium-alloy rails. I haven't the foggiest notion of what particular kind of alloy he has in mind ; but the single aluminium-alloy rail laid in the multiple-gauge straight run I had at my old home at Norbury, wasn't in the same street with the hard brass alloy rails which formed the rest of the track. The surface was everlastingly slippery, even when dry, aluminium being [redacted] naturally " greasy " metal ; and the concentrated weight of [redacted] passenger on four axles, caused the rail to sag between sleepers. Part of one of the American continuous lines is laid with aluminium-alloy rail (they leave out the last " i," and pronounce it " aloominum ") and I have heard from several sources that the engines slip like nobody's business on it, when pulling a decent load ; also that the railheads show signs of rapid wear.

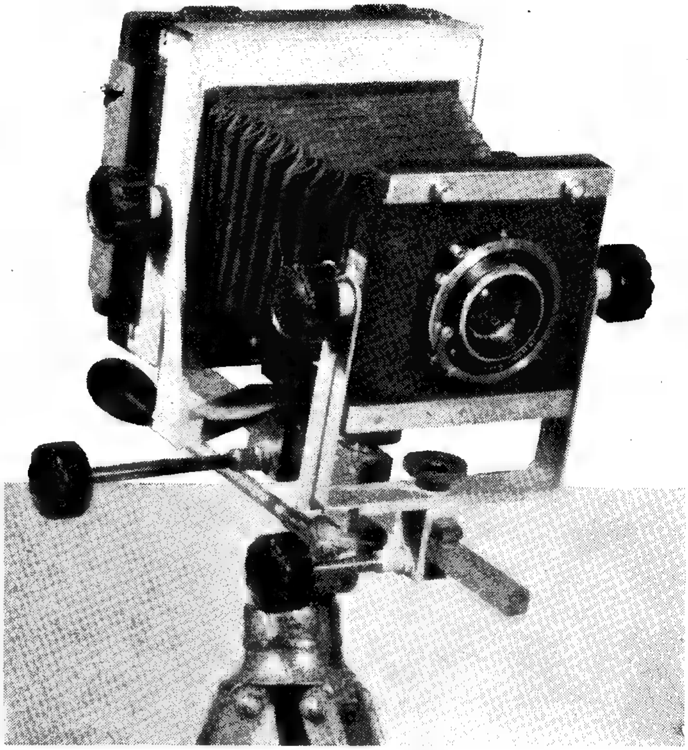
Talking about pronunciations, one of the B.B.C announcers gave me a " pain in the neck " by calling the motorcar city " CUV-ventry." I never heard [redacted] native call it by that name, all the time I worked there, travelling 102 miles each way daily. One of my dearest-cherished memories of Lady Godiva's home town, is that of [redacted] small kiddy singing " She was one of the aerly baerds, and I was one of the waerms " ; the most delightful voice and accent I ever heard !

A shy young beginner building a *Tich*, wants to know if it is correct that he will have to join an affiliated club and obtain a " driving certificate " before running his engine in public. Goodness gracious—NO !—what on earth next ? There are more than enough interfering bureaucratic busybodies, with their controls, restrictions, rules, regulations and what-have-you, in every walk of life ; and one of the purposes of a hobby is to " get away from it all," and enjoy a little freedom to do as you please. Persons trying the domination stunt, should be told exactly where they get off, as our transatlantic cousins would put it ; and as my dear old Victorian granny would have said—" them's my sentiments ! "

A CAMERA FOR WORKSHOP PHOTOGRAPHY

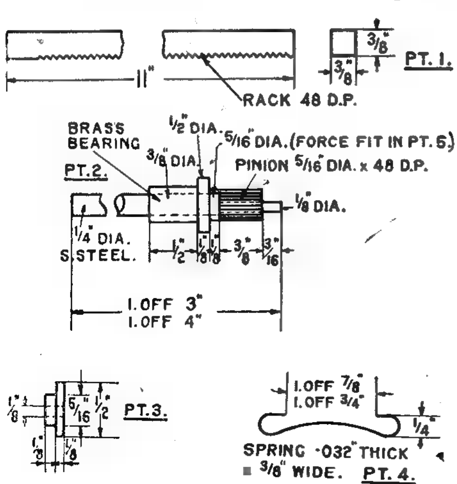
by
H. Arthur Clues

THE camera about to be described will fulfil all the requirements likely to be demanded by model engineers. It contains all the necessary movements, and, what is more important, a sufficient degree of such movements to enable really first-class results to be obtained. The bellows and dark-slides are commercial products, and it is advisable to obtain these before a start is made on the construction. The reason for this is because, although these parts are of nominal standard size, they vary slightly in external dimensions according to the actual camera they were originally designed to fit. The maximum size of plate the camera will take is quarter-plate ($4\frac{1}{4}$ in. $\times$ $3\frac{1}{4}$ in.) and the bellows used are double extension quarter-plate size. I would advise fitting this size bellows even if it is decided to use $2\frac{1}{2}$ in. $\times$ $3\frac{1}{2}$ in. plates, the extra extension will come in handy at times.



The camera arranged for horizontal pictures

With this type of camera it is not practicable to lay it on its side in order to take horizontal photographs. Instead, the extreme back portion of the camera is made reversible, enabling th plates to be used in either a vertical or horizontal position. In this case the bellows, too, are reversed as they are of oblong cross-section. If, however, the reader can obtain bellows of a square cross-section, then they can be fitted permanently in place.



Constructional Notes

The base bar (Pt. 1) is a length of $\frac{3}{8}$-in. square brass with a rack cut on one face to suit the pinions used. I bought commercial pinions of approximately $\frac{5}{16}$ in. diameter $\times$ 48 d.p. and then shaped the rack on the lathe to suit.

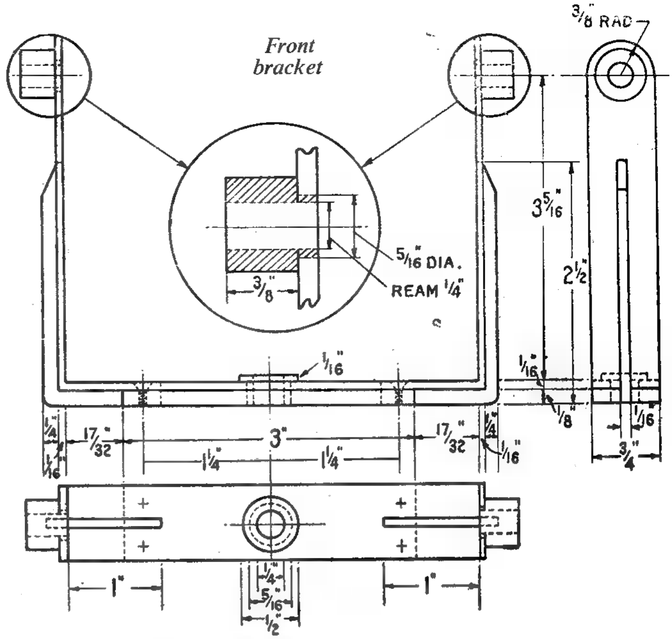
The three runners which ride on this bar (Pt. 5) and carry the front and rear brackets and the tripod bush were built up with further pieces of $\frac{3}{8}$ in. square material and $\frac{1}{8}$ in. thick brass. The position of the hole to carry the spindle and its pinion will be decided by the size of pinion used. It will be noticed that the actual size of the rectangular hole formed in this part measures $\frac{3}{8}$ in. wide $\times$ $\frac{7}{16}$ in. deep, this is to accommodate the spring (Pt. 4) which is fitted to take up any play in the focussing movement. It is important that the ends of this spring should

bear tightly on the faces of the runners to avoid rocking.

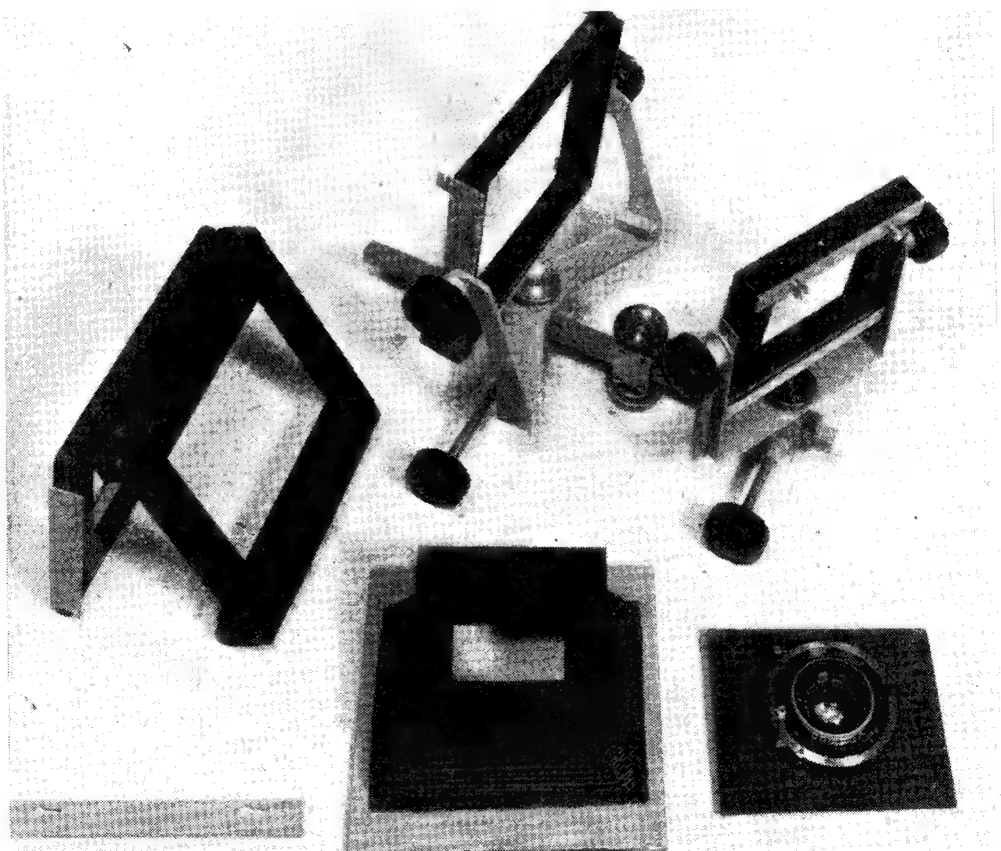
Silver-steel, $\frac{1}{4}$ in. diameter is used for the focussing spindles, carrying the pinion at one end and the focussing knob at the other. This is carried in ■ reamered brass bearing (Pt. 2) which is a force fit in Pt. 5, and a brass cap (Pt. 3) which serves also to close up the other end of the hole.

Both front and rear brackets are of quite straightforward construction and call for little comment. Bearing bushes and the stiffeners on the front bracket are soft-soldered in position, whilst the rear bracket is joined by 8-B.A. steel screws.

To construct the front panel proceed as follows: Cut a piece of $\frac{1}{4}$ in. thick 5-plywood exactly 4 in. square. In the centre of this



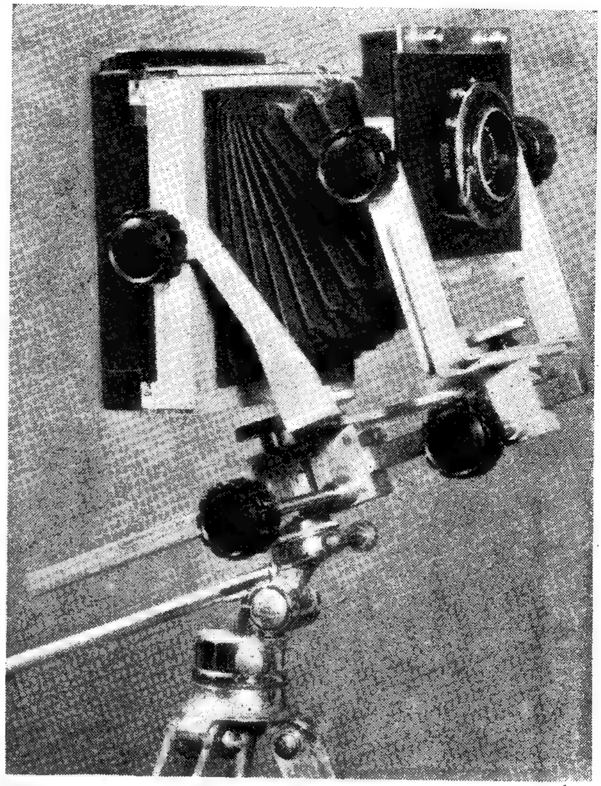
Below: *The component parts of the camera*



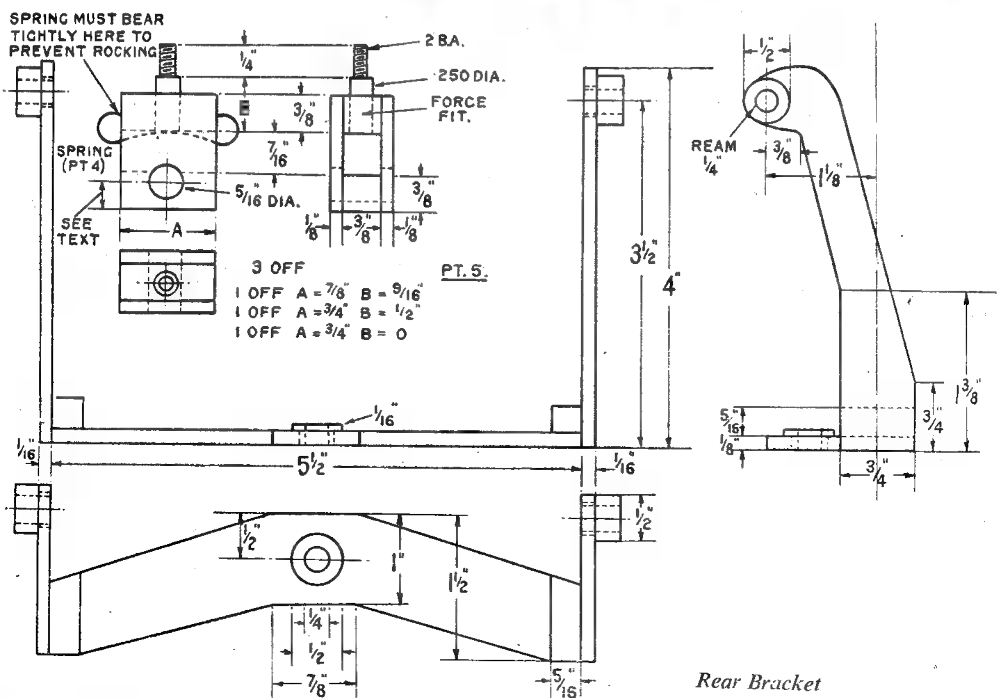
cut an aperture $2\frac{1}{2}$ in. square. Then from a piece of $\frac{1}{16}$ in. 3-ply wood cut a similar panel, but make the aperture $3\frac{1}{4}$ in. square. If you cannot get $\frac{1}{16}$-in. ply wood use aluminium sheet. These two pieces are now glued or screwed together, thus forming a recess to take the small bellows plate. To keep this plate in position a strip of thin metal is screwed to the bottom edge and overlapping the recess by about $\frac{1}{16}$ in., whilst the opposite edge carries two metal catches (*see* Fig. 6 rear view). I think the front view of Fig. 6 shows clearly enough how the lens panel is carried, it is similar to the rear, only the sides are open and it is lined with black velvet tape.

The bearing spindles are $\frac{1}{4}$ in. diameter silver-steel turned down for a length of $\frac{3}{8}$ in. at one end and threaded 2 B.A. The opposite end is turned down to 3/32 in. and riveted to the brass fixing plate, which in its turn is fixed to the panel with small wood-screws.

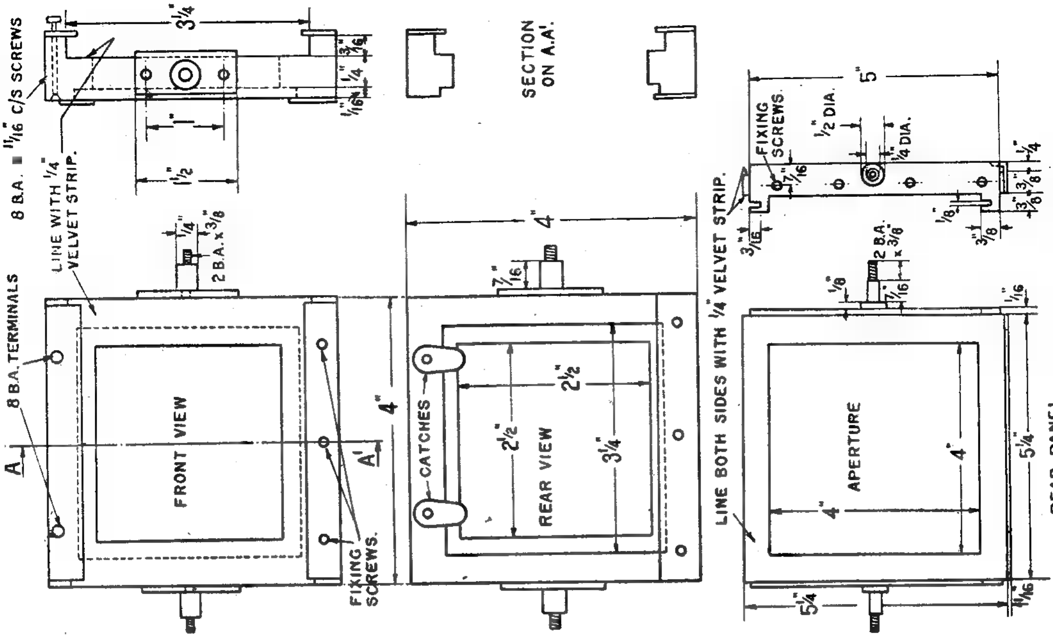
The reversing back is built up of $\frac{3}{8}$-in. ply wood, apertures being cut to suit the dark slides used. The reversing back is fixed in place by means of four $\frac{1}{8}$ in. diameter pegs (wood-screws with the heads cut off), which engage in the slots of the brass side plates on the rear panel (Fig. 7).



Right : The camera arranged for vertical pictures



Rear Bracket

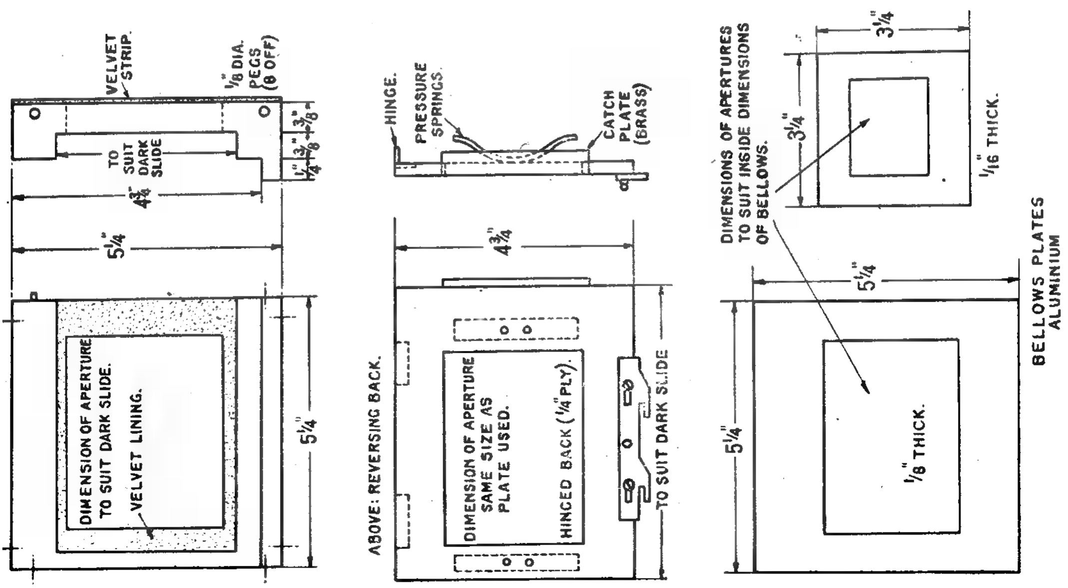


Left : *Fig*. 6. *Front panel. Right* : *Fig*. 7. *Rear panel*

These pegs should be put in on assembly to ensure a good fit.

The hinged back (Fig. 9) is made of ¼-in. ply wood and serves to hold the dark-slide in the focal plane. It should contain an aperture of the same size as the plates being used so that an image can be seen when the focussing screen is in position. The width of the hinged back is rather important. It should be of such a size that its right-hand edge, which carries the catch plate, should come in the same position as the edge of the dark-slide when in position in the camera. The catch-plate serves to hold the body of the dark-slide in position while the sheath is being drawn.

(*Continued on page* 674)



Left : *Fig*. 8. *Right* : *Fig*. 9

A Miniature Abrasive Band Machine

by A. R. Turpin

I WAS going to call this a "miniature linisher," and then a kind friend put me wise, and told me that the word "linisher" is the proprietary name for an abrasive band machine of a certain make, and so bang went an attractive title.

The machine about to be described was designed to fit into my already overcrowded workshop, and is considerably smaller than most commercial models, which usually take a band 4 in. × 36 in., whereas this one takes a size 3 in. × 24 in.

There is a snag here, inasmuch as the latter size is not a standard one, and I had to order a dozen bands at once, and they then took two months to materialise. However, it is a simple matter to increase the size to take the 36 in. band, as it only requires the main support bar to be lengthened 6 in. It would be as well to find out the availability of the 3 in. band as compared to the 4 in. one in your district, because it only means altering the length of the drums, but for the model engineer the smaller size is very convenient.

The description of the machine is as follows: referring to the drawing, a small stand (1), drilled for bolting to the bench, has a bracket with a split lug, in which is secured a short length of ¾ in. dia. B.M.S. bar, (2). On to this is clamped a double split lug (3), the axis of the split lugs being at right-angles to each other. This twin lug is clamped to the short length of bar (2), and also to a second similar, but longer, length of bar, (4).

On this bar is a second twin lug (5), which is clamped to it, and into the bottom socket is driven a spindle (6), fitted with a ball oiler, and drilled with oil ways. On this spindle rotates the drive drum (7), which is constructed of two cast-iron cheeks, a drive fit into a short length of 10-s.w.g. seamless steel tube.

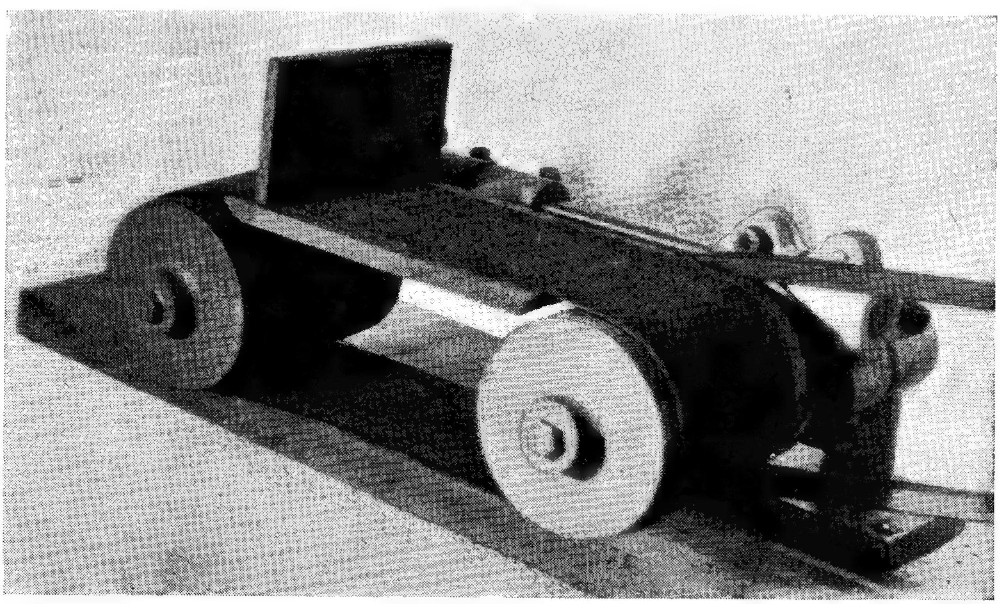
One of these cheeks has a groove for a vee belt turned in it, (8).

The drum is held on to the spindle by a large diameter M.S. washer and bolt (9).

The split lugs are clamped by Allen screws. A similar split lug (10), supports the second spindle, and the tensioning drum (11), which is similar to (7), except that it has no belt groove.

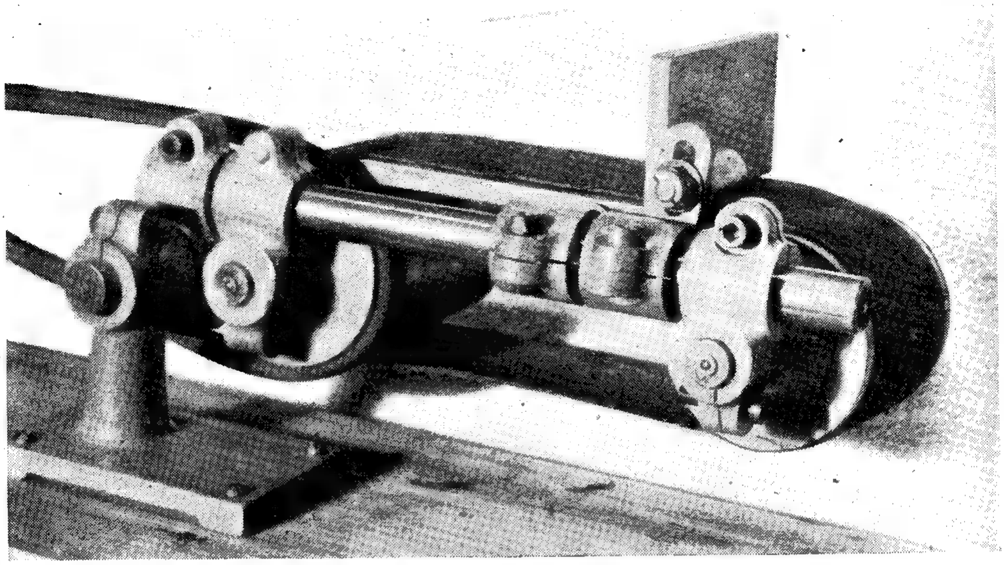
Both these drums are slightly crowned, and the tensioning drum is also used to centralise the abrasive band by altering the angle of spindle in relation to the driving drum by unclamping the lug, and rotating it slightly about the axis of the long shaft (3).

A flat table (12), is arranged under the band, and is secured to the long shaft (3) by a lug (13), the cast-iron table being fixed to the lug by a



Front view of abrasive band machine

short spindle which is a drive fit into a boss ■ the underside of the table, but is capable of rotation in the lug for adjustment, its position being finally locked by ■ 2-B.A. Allen grub-screw. A cast-iron fence (14) is fixed above the table, and is held in position by ■ stud passing through a slotted arm (15); it can be adjusted angularly and also for height.



Rear view of machine

The slotted arm is screwed to a split lug (16) on the long bar. (17) is the abrasive band.

When it is desired to polish curved work, the clamping-screw on the lug of the bracket (1) is released and the whole assembly revolved into a vertical position, and the unsupported side of the band is used. (See Photograph No. 3.) Some belt tensioning device must be fitted to the motor, a rocking bed being the simplest.

Machine Construction

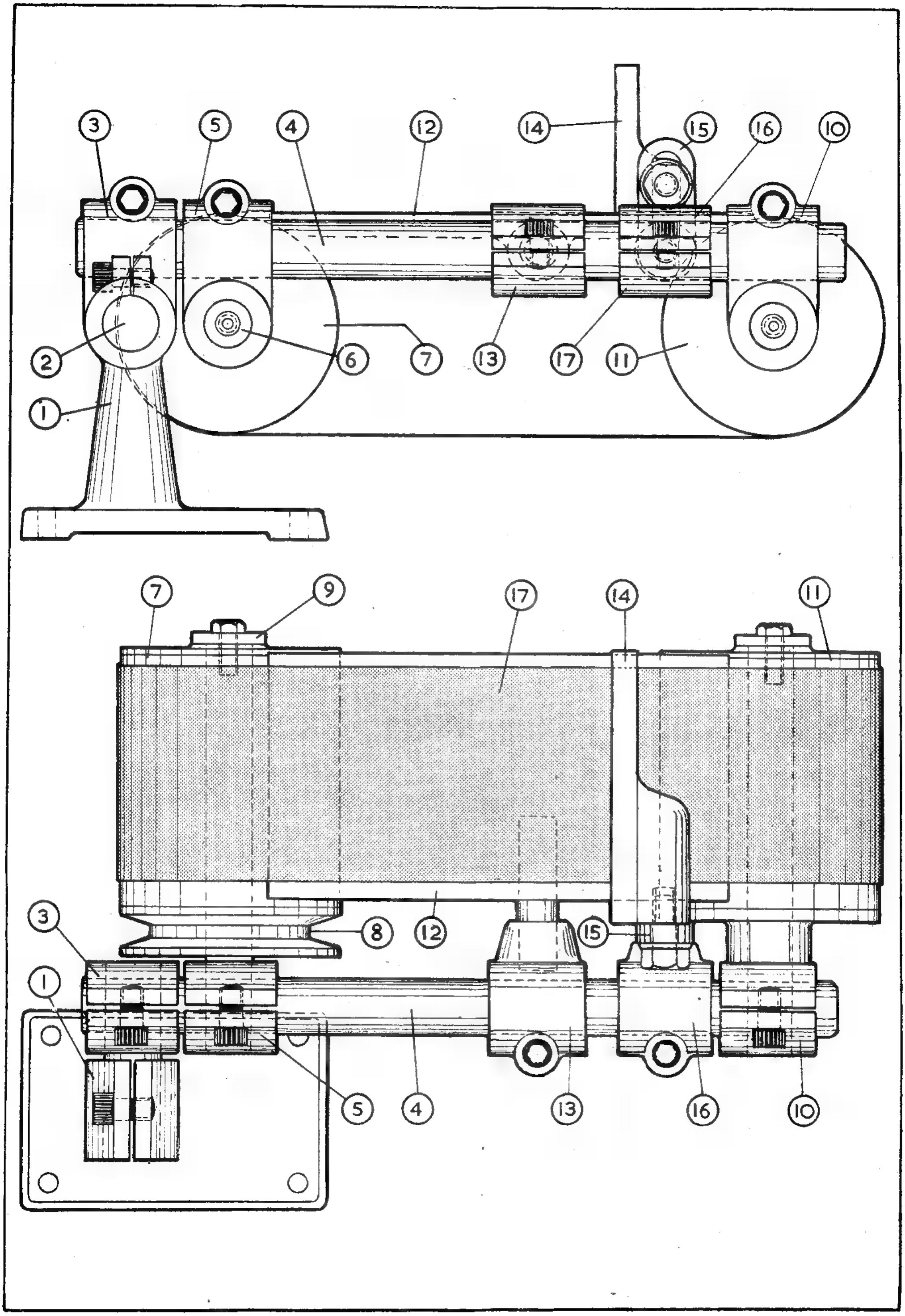
The stand is a simple iron casting, and the pattern can be made exactly like the drawing on the stand itself (see detail) except that the bearing boss will be solid, and there should be no holes for screws. It would be as well to make the boss $\frac{1}{8}$ in. longer on each side to allow for machining, and some "draft" allowed on the bottom of the feet. The casting can be cleaned up, the feet filed square and true, and then the four $\frac{1}{4}$ in. dia. holes for the securing bolts can be drilled, and these holes can be utilised to bolt the bracket to the vertical slide so that the boss may be drilled, bored and faced. The bracket is then turned through 90 deg., and the hole for the clamping-screw drilled and tapped $\frac{5}{16}$ in. B.S.F., and the slit cut through the boss with ■ $\frac{1}{16}$ in. metal circular saw mounted between centres, or with a hacksaw.

The $\frac{3}{4}$ in. supporting bar is then cut to length, and the ends faced. The three split lugs can next be tackled, and these are again iron castings, and the patterns can be built up from $1\frac{1}{4}$ in. dia. wood rod. The castings are cleaned up, and then mounted in the four-jaw chuck to drill, face, and bore the $\frac{3}{4}$ in. dia. hole, then drill, tap, and slot the clamping-screw hole for this lug, but the $\frac{5}{8}$ in. holes in two of these castings, and $\frac{3}{4}$ in. hole in one of them, must be drilled and bored exactly at right-angles to the first hole: in order to be certain of doing this, the vertical slide is set up with its face parallel with the chuck face, and ■ short length of $\frac{3}{4}$ in. dia. bar is then secured to the vertical slide by means of toe-clamps, the bar resting in one of the bolt slots which will position it parallel with the cross-slide. The bar is positioned so that it projects $1\frac{1}{2}$ in. beyond the edge of the vertical slide, and ■ split lug is secured to this by clamping it by its own clamping-screw, and after having adjusted it to hang in ■ true vertical position, the $\frac{5}{8}$ in. dia. hole is drilled and bored so that the spindle for the rollers is a drive fit in it.

The spindles are mild-steel bar, and should be cut to length, faced, and then drilled to take the ball oiler for the oilways.

When the spindles are forced into the lugs, take care that the oil holes are at the bottom. The $\frac{1}{4}$ in. B.S.F. hole is drilled and tapped for the retaining bolt, and the spindle should then be lapped to ■ good finish.

The drums may be built up from two cast-iron end cheeks, and a length of 3 in. dia. × 10-s.w.g. seamless steel tube, from ■ solid aluminium casting, or turned from solid hardwood, oak, beech, or mahogany. In the two latter cases, bronze bearings should be forced into the drums and then reamed to size. All drums should be given slight crown, say $\frac{1}{16}$ in., and this crown may now be turned on them by mounting them on a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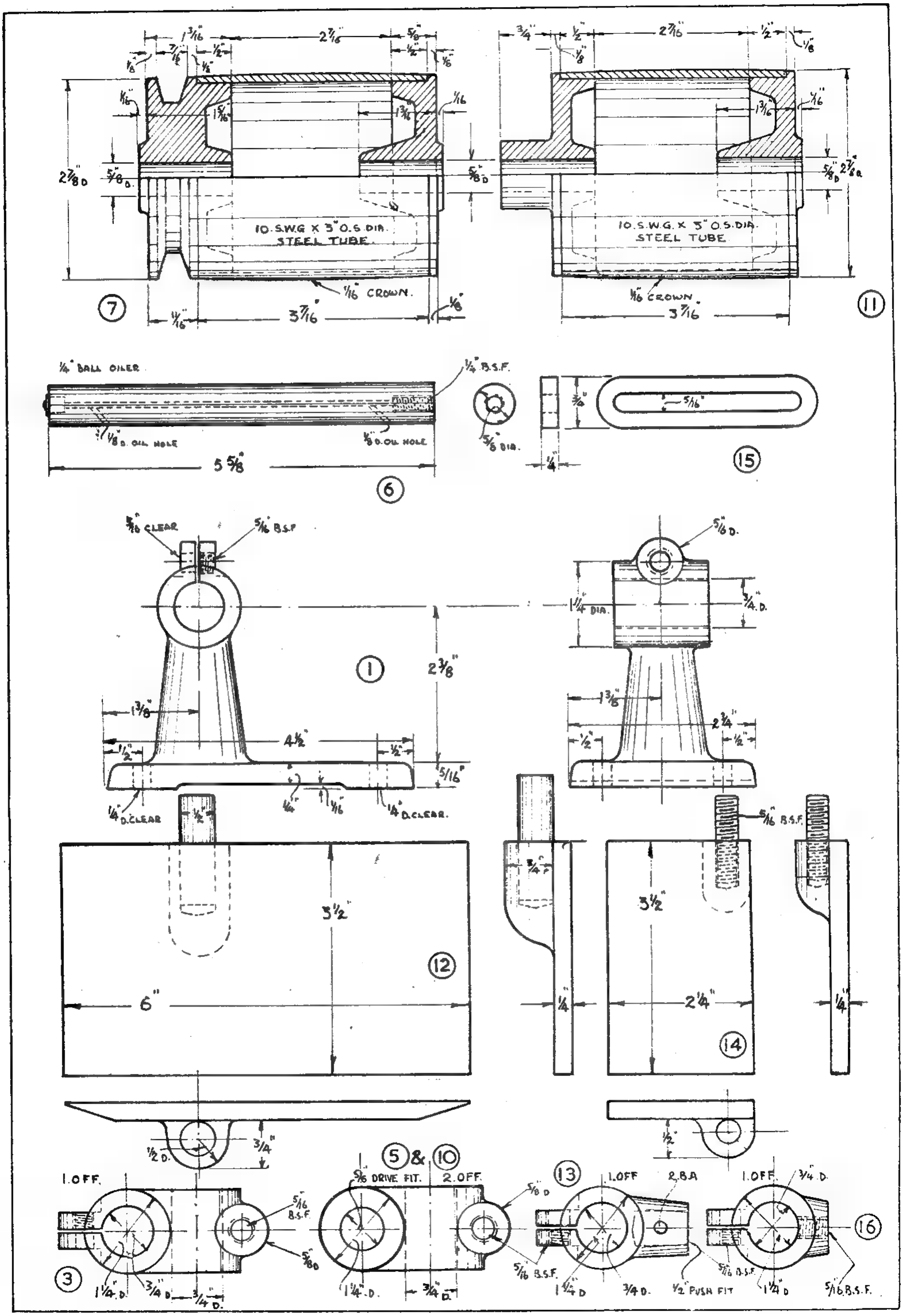

10. S.W.G × 3" O.S. DIA. STEEL TUBE
1/16" CROWN
1/4" BALL OILER
1/8" D. OIL HOLE
1/4" B.S.F.
5/16" CLEAR
5/16" B.S.F.
1 1/4" DIA.
1/4" D. CLEAR
5/16 DRIVE FIT.
1. OFF.
2. OFF.
1/2" PUSH FIT
2 B.A.
5/16 B.S.F.

mandrel running between centres ; the belt groove and all the outside surfaces may be turned at the same time.

The drums should now be balanced whilst still mounted on the mandrel.

The cast-iron table was mounted on the faceplate by drilling and tapping two holes in it, and using these holes to bolt it to the faceplate of the lathe, suitable packing having been placed behind it ; an extra $\frac{1}{2}$ in. was cast on either end of the table for this purpose, and was afterwards sawn off. The table was then faced.

A 15/32 in. hole was drilled in the boss, and the end of a length of $\frac{1}{2}$ in. M.S. bar turned down so that it is a drive fit in it.

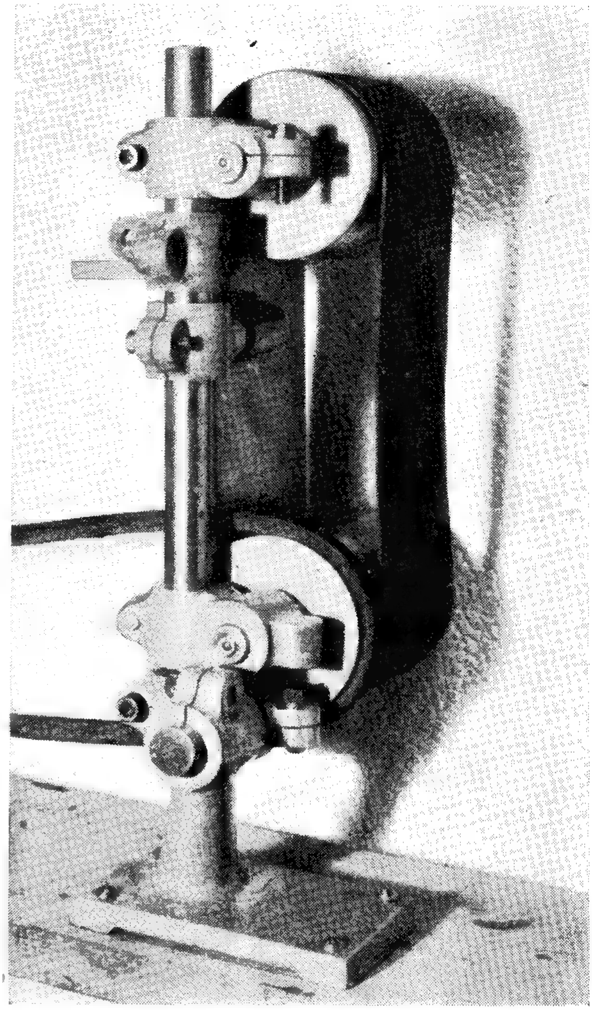
The projecting end, which should be the original $\frac{1}{2}$ in. dia., is a push fit in a $\frac{1}{2}$ in. hole drilled in the lug which secures it to the main bar, and having been positioned, is held by a 2-B.A. Allen grub-screw.

The fence was machined by gripping it in the four-jaw chuck, and the boss was then drilled and tapped $\frac{5}{16}$ in. B.S.F. and a short stud screwed into it and its securing lug tapped similarly.

The slotted arm was milled from $\frac{3}{4}$ in. $\times$ $\frac{1}{4}$ in. M.S. bar, but it could be drilled and filed.

When the band is used in a vertical position on curved work, only a gentle pressure should be used, otherwise the band, being unsupported, might be fractured. A better scheme for polishing curved work, using considerable pressure, would be to substitute the cast-iron idling drum by a felt-covered bob ; the difficulty would be in obtaining one the right size, but it would not be very difficult to make one.

I have been unable to find any data as to the correct speed at which the abrasive band should be run, but have got quite efficient results at 1,000 ft./min.—compared with the speed of a polishing bob, this seems to be extraordinarily low.



Machine in vertical position for polishing convex work on the unsupported band

A CAMERA FOR WORKSHOP PHOTOGRAPHY

(*Continued from page* 669)

Standard radio knobs are used on the focussing movement and the tilting back and front. Tapped brass bushes being force fitted to these knobs where necessary. However, brass clamping-screws are fitted to the swinging movements in order to conserve space. These are 1 in. diameter by $\frac{3}{8}$ in. deep, tapped 2 B.A.

The central runner, by which the camera is fixed to the tripod, is drilled and tapped $\frac{1}{4}$-in. Whitworth on its underside, the opposite side being drilled and tapped 0 B.A., and carries a locking-screw to clamp it to the base bar.

As regards an adhesive for fixing velvet ribbon, I strongly advise Bostick 252, it is the only "sticky-stuff" I know of which does not seep through the ribbon and ruin the pile of the velvet. This same cement is used for fixing the bellows to their plates.

Small Drill Grinding

by S. F. Weston

THE article on "Small Drill Grinding" in the issue of November 16th, 1950, was most interesting and useful.

Basing on the assumption made therein that there is a wood bench available by the grinding wheel, is such an elaborate arrangement necessary?

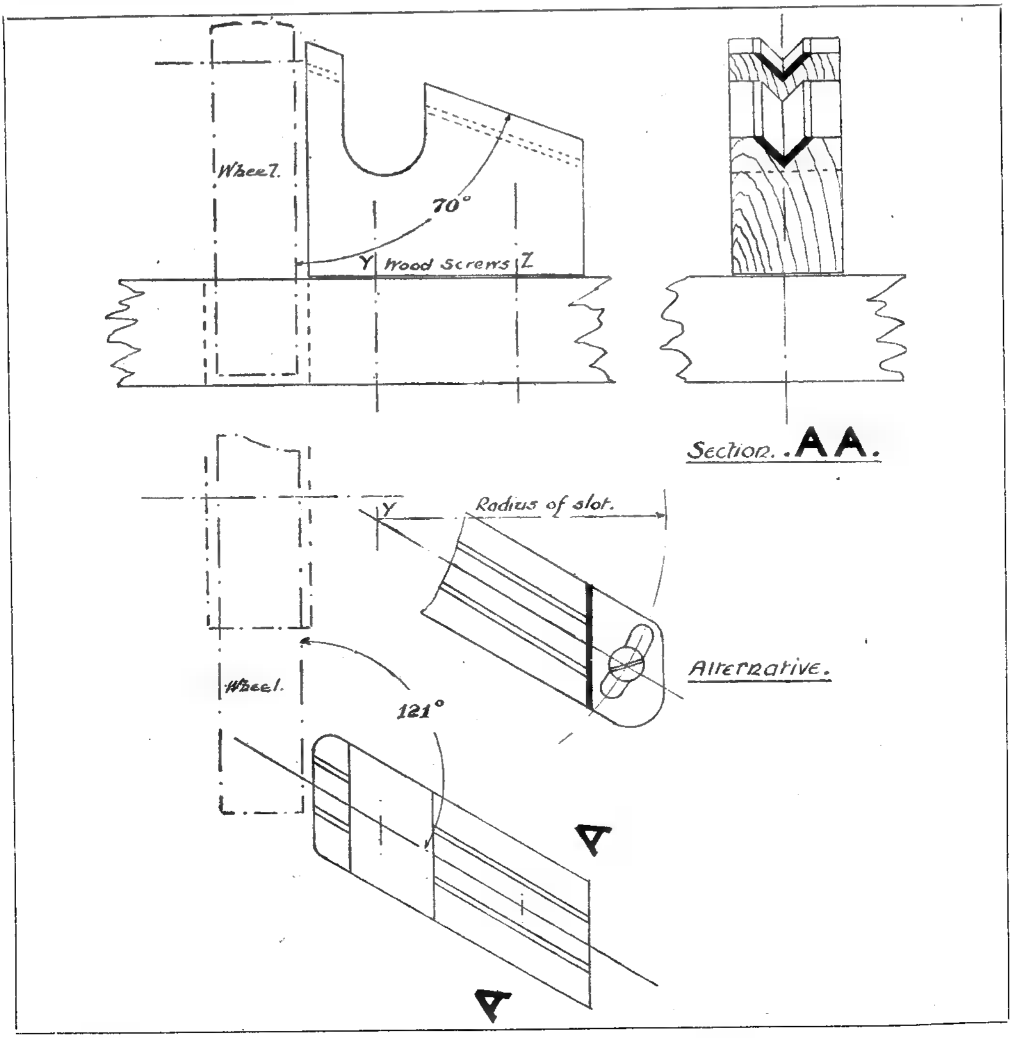
That shown in the article requires some fitting of no mean order to make it accurately—the sliding vee-block for instance.

The result to be obtained is an inclined vee at 70° to the vertical face of the wheel and set at an angle of 121° thereto. Surely this could be obtained in a much simpler manner, using only two parts, viz. a small piece of hard wood and a short length of $\frac{3}{8}$in. × $\frac{3}{8}$ in. × $\frac{1}{16}$ in. brass angle.

Accurately cut the wood at an angle of 70° form a vee to receive the brass angle and attach same by small wood screws well countersunk. Mark off carefully the angle of 121° from the vertical face of the wheel on the surface of the bench and fix the prepared block to that angle, having previously cut out, as shown to allow for the drill to be rotated to obtain the backing off.

If it is necessary to provide for grinding at different angles, use only one screw *Y* for attaching the block to the bench and fit the small slotted angle-piece, as shown, alternatively.

This arrangement, whilst fulfilling the requirements, is quicker and less costly, as well as more rigid.



*A Portable Tape Recorder

With Notes on Magnetic Recording

by Raymond F. Stock

ONE effective deck layout requiring an inward wound tape is shown in Fig. 6. This is suitable for a more elaborate machine, and has the advantage of requiring no manual re-threading of the tape when changing from recording to rewind. The tape follows ■ roughly similar path in both cases, but it will be seen that a apparently crude, is accurate to within 10 sec. or better.

Whatever type of mechanism is used it is highly desirable that all sources of mechanical noise are silenced as far as possible, since the deck is usually in close proximity to the speaker during reproduction and is often quite near the

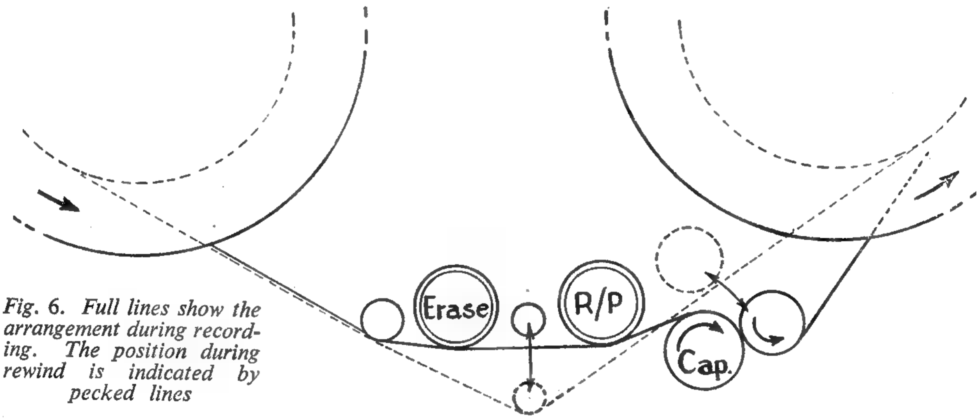


Fig. 6. Full lines show the arrangement during recording. The position during rewind is indicated by pecked lines

central idler roller moves forward during rewind and lifts the tape off the heads ; at the same time the pressure roller swings into a position where it acts as another idler.

The mechanical movements are performed by means of cams on the main control shaft which also carries switch wafers which carry out the necessary motor and amplifier switching. With such an arrangement it is usual to fit another position to the control knob giving ■ fast forward wind. This is done by energising the take-up motor fully, since during normal forward movement the motor is fed via a resistance. "Fast forward" speed is ■ convenience but is by no means essential.

Another great convenience is to be able to pick out ■ given spot on the tape during rewind, when only a portion of the tape is to be re-played.

Two forms of cueing indicator may be used ; either an illuminated scale beneath the rewind reel so that the diameter (and therefore a chronological position) of the tape may be estimated, or ■ gear driven dial or dials which is, of course, the most accurate method. If the latter system is used the rewind reel must of course be positively locked to the rewind shaft (from which the dials are driven). In practice the former idea, though

microphone during recording. Ideally the mechanism should be rubber mounted, and boxed in when running by ■ felt lined lid. It will be seen that the problems arising in designing ■ satisfactory deck are many and varied and give fair scope to the ingenuity in providing the most compact layout with the greatest ease of handling.

Design

The design of a recorder, as of any machine, is ■ series of compromises ; in this case between high quality reproduction, bulk, weight and expense on the one hand and a compact apparatus with a somewhat reduced performance on the other.

The recorder described in this article is intended to be the smallest and lightest equipment capable of giving ■ reasonable quality. The latter term is vague and requires some amplification.

Any piece of electronic recording or transmission gear may be accurately measured for fidelity of reproduction, and its performance noted as a graph of output at various audio frequencies.

Such a test, though often valuable commercially, gives no accurate index of the quality of sound under normal conditions, since ■ number of intangible factors are then involved such as the quality of the microphone and speaker and the acoustics of the recording and reproducing rooms.

*Continued from page 633, "M.E.," May 15, 1952.

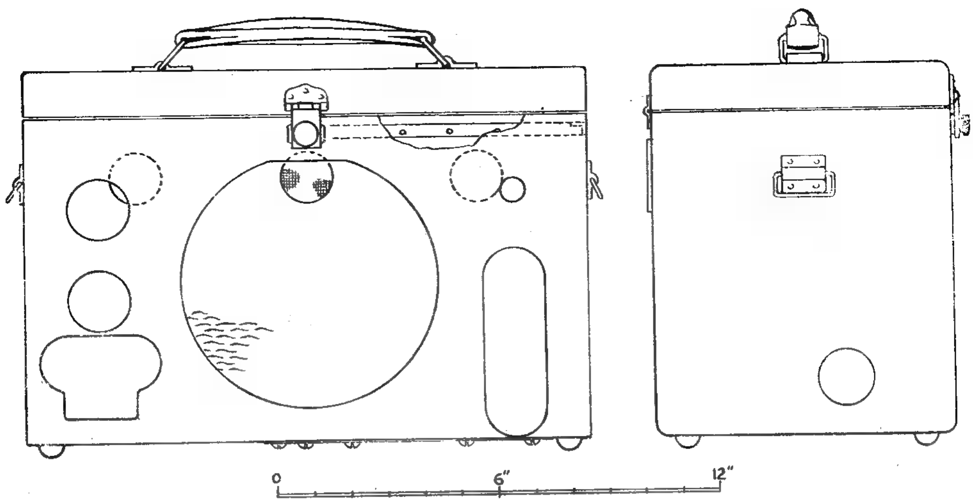


Fig. 7. The case

For this reason no statistics are quoted for the machine described, but it is conceded by most auditors that the reproduction from a radio or gramophone input is hardly inferior to the original programme or record; this may, of course, be taken as a criticism of the average radiogram!

When recording from life the quality will largely depend upon the microphone used (and vary probably, as the square root of its cost). Nevertheless with a relatively cheap crystal mike the standard is quite satisfactory for normal purposes, and is in any case largely influenced by the circumstances of the recording, room acoustics, etc.

A small metal box packed with mechanism is not the most suitable baffle for a loud speaker, and an extension speaker socket is incorporated; the use of the latter—conveniently with one's normal radiogram speaker—is obviously beneficial to results.

The apparatus divides—both physically and for the purpose of description—into four main units:

(1) The case.
(2) The deck.
(3) The amplifier.
(4) The power supply and oscillator.

Since few dimensions in the machine are critical most of the illustrations omit them; the drawings are however, to the scale shown.

(1) The Case

Fig. 7 shows the external appearance of the case which is an aluminium box bent and welded to shape from 14-g. material. This started life as an Army wavemeter type C and suited the mechanism admirably. Sundry internal partitions were removed and the various holes cut with a tank-cutter and fretsaw. The purpose of the holes in the front is obvious from the photographs, and a large hole in the bottom is covered by a sheet of perforated zinc retained by [illegible] round head screws. This enables one to adjust and service all the amplifier components without dismantling the machine.

The front of the lid was fitted with a strong catch since the whole weight is taken on it when using the carrying handle. For any protracted personal portage the end lugs are used to pick up on a shoulder sling.

The hole in the left hand side registers with the mains socket, and the three holes in the back are covered with gauze to permit exit of the cooling air drawn in from below the chassis.

A partial ledge of brass angle framed the inside of the box near the top, as purchased, and this ledge was continued on all sides to form a support for the tape-deck.

After assembling and testing the complete machine, the case was stripped down and the remnants of its khaki paint removed. It was finished in black crackle, an eminently practical and economical surface.

The interior of the lid was lined with felt.

It may be stated that the purchase of the wavemeter dictated the size of the machine, this having been previously estimated at a quarter as large again. The cost of the wavemeter was 15 shillings—less than the value of aluminium to construct a case—and the internals provided all chassis and panel material and bolts—not to mention about 12 feet of small-bore copper tubing! A good buy.

(2) The Deck

Figs. 8 and 9 show a plan of the deck from above and a reversed plan from below. In Fig. 8 the parts shown are (A) Rewind shaft, (B) Cueing scale, (C) and (D) tape guides, (E) Permanent magnet, (F) Erase head, (G) Record/playback head, (H) Capstan, (I) Pressure roller, (J) Take-up shaft, (K) Lid strut, and (L) Control knob.

The basis of the deck is the main panel, cut from 16-g. galvanised steel sheet $7\frac{3}{4}$ in. × $12\frac{3}{4}$ in.

The only work involved in this was cutting the large holes for the capstan, take-up shaft

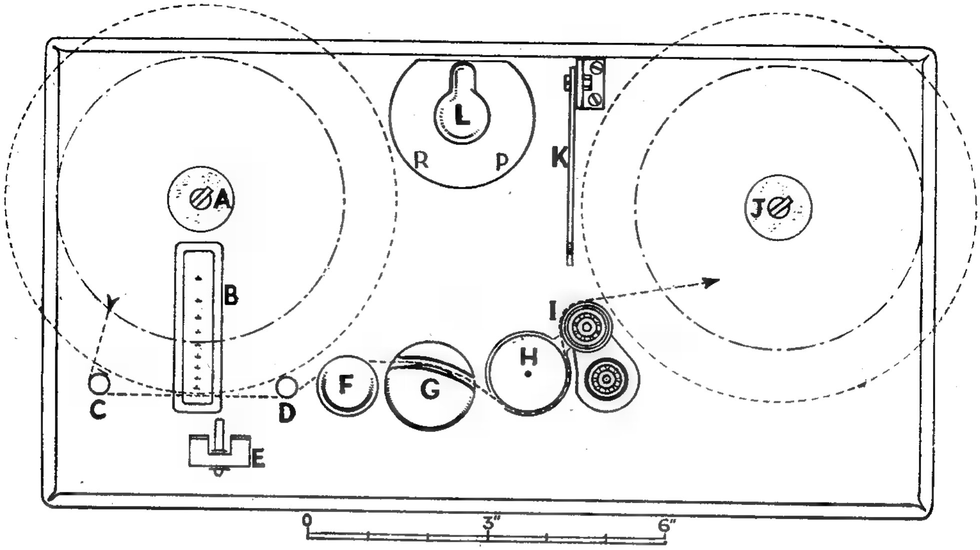


Fig. 8. Plan of deck in rewind position. The tape is indicated in the playback position

and rewind shaft and cueing scale, together with numerous drilled holes for fixing various components underneath. The panel is finished in a fine crackle finish and its edge is enclosed by a length of ¼ o.d. rubber tubing slit along one side and pressed on to the panel, using mitred corners. This neatens the edge and provides a resilient mount for the whole deck. The rubber rests on the ledge near the top of the case and the deck is positioned laterally by the sides of the box which project above the angle as shown in Fig. 10.

The two tape guides mentioned were purchased commercially, for the sake of their hard chromed surface, and these were tapped 2 B.A. into their bases, and bolted from underneath.

The cueing indicator is no more than an ivorine slip retained immediately below the reel by a chromed bezel, cut down from a square clock dial, and positioned over a long slot in the panel. A pilot light in the power pack is fitted below the opening, and enables the radius of the tape to be accurately estimated provided the eye is held directly above it (to eliminate parallax). A non-linear scale was engraved on the ivorine, copied from the markings on the tape reel, but any graduations, however nominal, will serve as a reference.

The magnet (E) requires some explanation. Given sufficient erase power the supersonic erase head should cope with any recorded signal. It was found, however, that due to the limited size of the power pack, insufficient H.F. was available

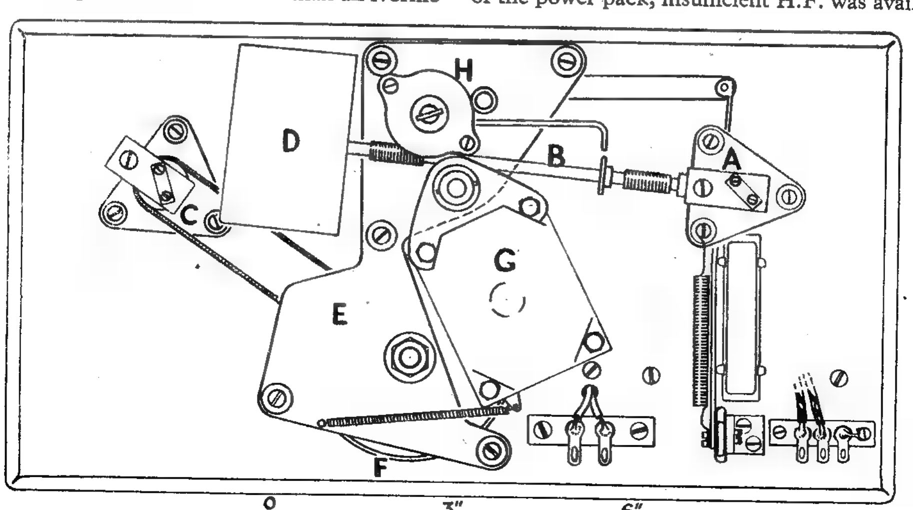
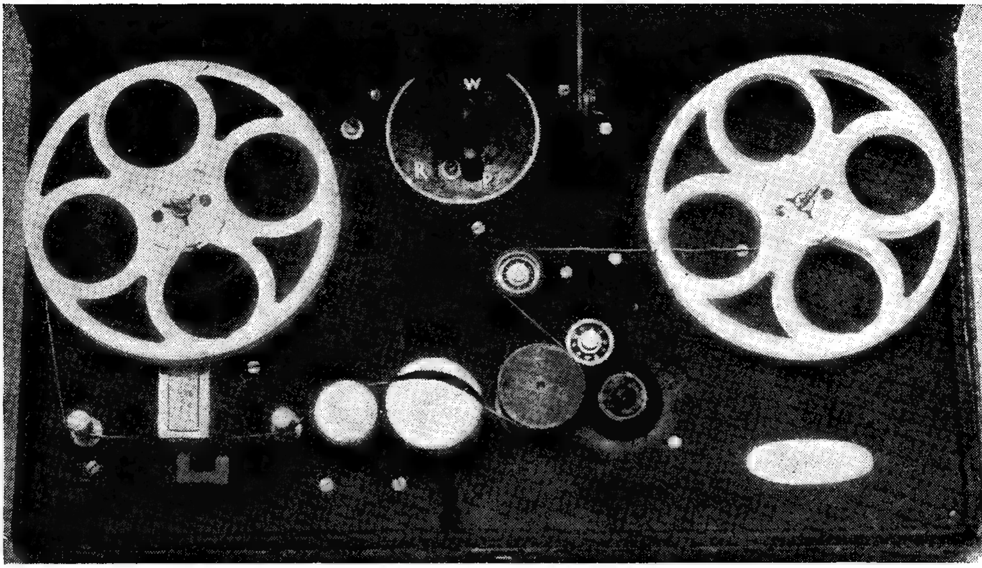


Fig. 9. Underside of deck



Recorder deck. The idler following the pressure roller has since been removed

completely to eliminate an over-recorded passage, so the small permanent magnet shown was incorporated. Any hiss left on the tape from this component is dealt with by the erase head following it. Since the magnet must not contact the tape during playback it was mounted in a clip holder on the end of a swinging arm which moves forward during record only. The magnet can be completely removed for certain purposes.

The pressure roller consists of a $\frac{5}{8}$ o.d. ball-race mounted on a stub screwed into the end of a short swinging arm. Pressed over the ball-race is a length of brass tubing, and forced over this is a piece of hard rubber tube ground true after cementing in place with Bostik. The overall diameter is $\frac{7}{8}$ in.

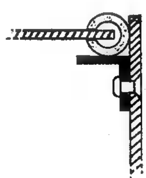


Fig. 10. Sectional view of the resilient mounting for the deck

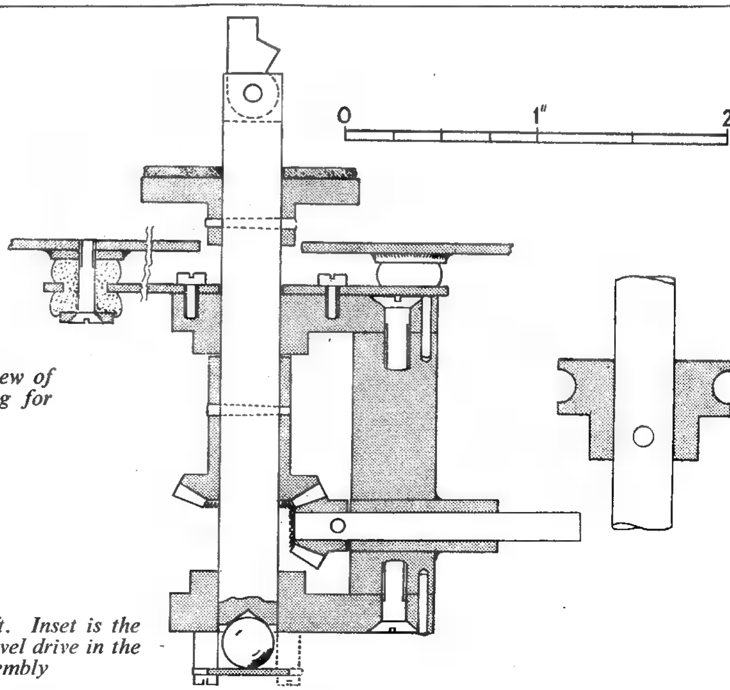


Fig. 11. Rewind shaft. Inset is the pulley replacing the bevel drive in the take-up assembly

The swinging arm is pivoted on another ball-race which is pressed into a holder of such a size that no appreciable play is left in the bearing. It is essential that this component should be sturdy and free from play. A pin projects downwards from the end of the swinging arm, through the deck, and receives the end of the pressure roller tension spring.

It will be seen that the components of the deck have been arranged so that 7 in. reels may just be accommodated with the lid open (note pecked circles in Fig. 8) and 5 in. reels can be played with the lid closed (note chain-dot circles).

In Fig. 9 the essential components are (**A**) Rewind shaft assembly, (**B**) Rewind drive-shaft, (**C**) Take-up shaft assembly, (**D**) Rewind motor, (**E**) Capstan platform, (**F**) Flywheel, (**G**) Capstan motor, (**H**) Switch assembly.

The rewind and take-up shaft assemblies are similar. Fig. 11 illustrates the rewind component and the take-up mechanism is identical except for the substitution of ■ pulley for the bevel wheel on the shaft, and the elimination of the bevel pinion, shaft and bush.

Referring to Fig. 11, the rewind shaft is of $\frac{5}{16}$ in. silver-steel slotted at the top to receive ■ hinged tab. The latter engages with one of the slots around the hub of ■ standard reel and serves to lock the reel to the shaft when required.

The shaft is carried in two bronze bearings spaced apart by ■ brass pillar, and at the lower end rests on ■ $\frac{1}{4}$ in. ball for a thrust bearing. The ball runs against a slip of spring steel bolted across the lower bearing.

Nine-sixteenths of-an-inch from the top of the shaft is positioned the face of a turned collar pinned to the shaft. Its upper surface is covered by a felt washer on which the spool rests.

The rewind shaft is bevel driven (at 2 : 1 reduction) from the pinion shaft of 5/32 in. silver-steel. This shaft is spring-coupled to the rewind drive shaft which is similarly connected to the spindle of ■ standard Collaro rim-drive gramophone motor mounted on its side directly below the deck.

The rewind and take up bearing assemblies are each provided with ■ triangular aluminium plate bolted (via rubber bushes) at each corner to the deck.

The central portion of the deck is occupied by ■ $\frac{1}{8}$ in. thick aluminium platform which serves mainly to support the capstan and its motor.

The platform is hung from five aluminium pillars via rubber bushes, the pillars being bolted at their upper ends to the underside of the deck panel.

Fig. 12 shows a section of the capstan and flywheel mounted on its journal. The latter, of steel, is bolted through the capstan platform and supports the capstan in the centre of the clearance hole in the panel. The capstan is turned on all surfaces, from ■ gunmetal casting, and ground on its working face. It is of course essential that the bearing surfaces should be well fitted, preferably lapped. The capstan is completed by ■ band of rubber bostiked around the periphery of the flywheel; this was ground true after the cement had dried. The small hole at the top of the capstan assists assembly (by "decompressing" the bore) and permits occasional oiling of the bearing surfaces.

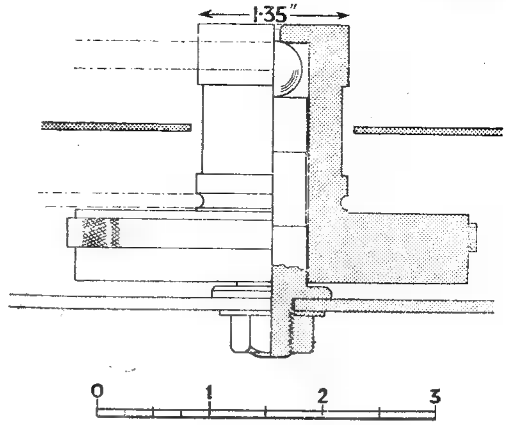


Fig. 12. *Capstan and bearing*

The capstan motor is ■ rim drive Collaro gramophone type, and has ■ bush bolted by brackets to one side. The motor is supported by ■ shaft of $\frac{1}{4}$ in. silver steel passing through the bush and anchored through the capstan platform and (via a rubber bush) to the deck panel above. The motor pivots around the shaft and is normally pressed towards the capstan by a light spring.

The motor shaft is provided with ■ steel bush of approximately $\frac{5}{16}$ in. outside diameter. This runs against the rubber rim of the flywheel and thus transmits the drive; its actual diameter was obtained by trial and error until the capstan passed the required $7\frac{1}{2}$ in. of tape per second.

A useful modification to the drive would be to fit a permanent sleeve to the motor shaft giving a tape speed of 3.75 in./sec and to provide slip-on bushes giving other speeds of 7.5 and 15 in./sec. This would enable the tape to be used twice as economically when recording speech alone or alternatively to give a higher quality (at 15 in./sec.) for music. The sleeves could be stored in the lid of the case and changed through an access panel in the deck.

(*To be continued*)

MINIATURE ROAD RACING

We recently paid a visit to Eel Pie Island, Twickenham, where the local authorities were receiving their initial impressions of this fascinating spectacle from demonstrations carried out on the "M.E." Exhibition circuit, loaned for the occasion.

There are already ■ fair number of enthusiasts banded together to form the nucleus of what should be a very interesting club, and they are open to applications for membership from all who have at heart the development of miniature road racing.

The site at the Eel Pie Island Hotel is ■ very fine one, which will allow the laying of a really interesting circuit of considerable size. It is accessible from all parts of London. Readers interested in real scale model racing should write to D. J. Roskilly, 36, Seymour Road, Acton Green, London, W.4.

Novices' Corner

Some Aids to Hand-Tapping

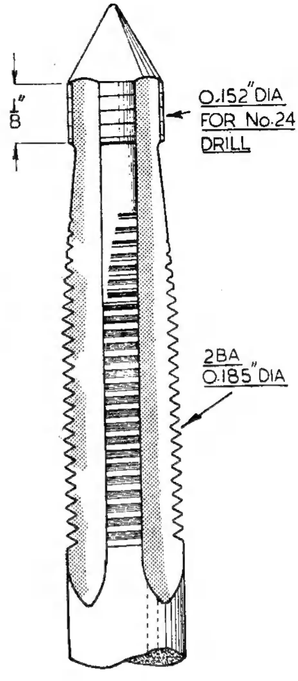


Fig. 1. A ground-thread, taper tap with guide at tip

MOST workers will, no doubt, welcome anything that will save some of the labour of hand-tapping holes of medium size in the harder metals. Modern, high-speed steel, ground-thread taps will not only thread holes much more easily, but they are stronger than carbon-steel taps and retain their sharpness longer. This means that tap breakage resulting from too heavy handling will be reduced, and the free-cutting action of these taps usually enables them to be screwed straight into the material without constant backward and forward working. As an example, 2 B.A. and ¼ in. B.S.F. taper taps were put through a piece of mild-steel, ⅜ in. in thickness, by continual forward turning.

As compared with ordinary carbon-steel taps, these modern taps are somewhat expensive ; but it is not suggested that a complete set should be purchased, for all that most workers will want is a taper and plug tap of the sizes commonly used in light constructional work, say, 2 B.A. and ¼ in. B.S.F.

In this connection, ground-thread, circular dies are also manufactured, but as the ordinary, and much cheaper, dies cut a good thread at a single passage over the work, there is, here, no marked advantage for the amateur user.

Ground-thread, high-speed steel taps manufactured by Messrs. Lehman Archer, as well as those of the Warrior brand, have been obtained from Messrs. Buck & Ryan. These taps are of good quality, and examination with a lens shows a much smoother finish than is usually seen where the threads have been merely machine-cut ; moreover, the threads formed in the work are left with a high surface finish.

Lubricants

When tapping steel, the use of a proper lubricant does much to reduce the effort needed and, at the same time, a better finish is given to the work. Lard oil is good for this purpose, but one of the modern tapping fluids with a lanoline base is much better. The preparation manufactured by Messrs. Sozol Ltd. has been found to promote free-cutting, and even soft iron can be tapped without tearing and roughening the surface of the threads.

Tapping Sizes

Whatever kind of taps are used, there is much to be gained by adopting tapping sizes that leave a thread of no greater depth than will afford an adequate hold for all ordinary purposes. If the diameter of the tapping hole is equal to the diameter of the tap measured across the roots of the threads, the thread then formed will engage fully with the threads of a standard nut ; that is to say, the engagement will be 100 per cent.

In these circumstances, some difficulty may be found in entering the tap, and it will probably have to be worked backwards and forwards in order to make an advance of half a turn at a time.

Not only does this waste time, but there is always the danger of breaking the tap. However, it has been shown that over-tightening a mild-steel nut, having a thread of only 75 per cent. of the full depth, will twist off the corresponding bolt before stripping the threads in the nut itself. Nevertheless, it is usual to work to a depth of thread of some 80 per cent. for mild-steel and 85 per cent. for cast-iron.

Reference to three different, authoritative threading tables, published within recent years, showed that a No. 26 drill was recommended as the tapping-size for No. 2 B.A. Now, the diameter of this drill and the root diameter of the tap are both almost exactly 0.147 in., so that the depth of thread cut would be approximately 100 per cent. It is obvious that but little hold is given by the extreme tips of the thread, and this can be demonstrated by drilling a hole in a piece of mild-steel, ⅛ in. in thickness, with a No. 16 drill, and then threading the material with a No. 2 B.A. tap. The thread formed in this way will represent fairly exactly a thread depth of 20 per cent., corresponding to the loss of engagement when a No. 23 drill is used instead of a No. 26 tapping drill. To gauge the holding power of this extra 20 per cent. of thread depth, insert a screw and turn it until the thread strips.

The drawing (Fig. 1) shows a modern, best quality, taper tap, and it will be seen that the

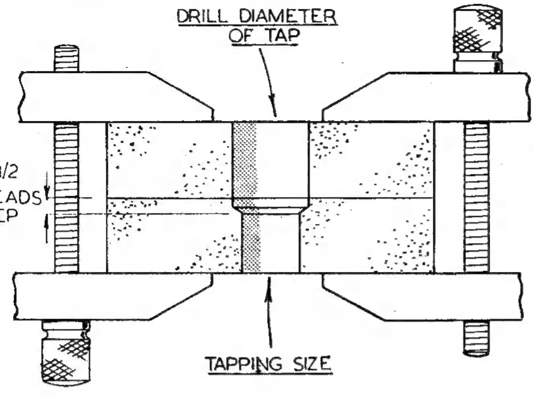


Fig. 2. Using the work-piece to align the tap

tip of the tap is formed with a cylindrical guide to fit a No. 24 drill hole. This part of the tap is not backed-off and it will, therefore, not serve as a reamer if an attempt is made to enter the tap in a hole of too small diameter; moreover, the shank of the tap is engraved with the words: "Use 24 drill."

This question of tapping sizes is fully considered in the book *Screw Threading and Screw Cutting* published by Percival Marshall & Co. Ltd., and tables showing tapping drill sizes for different depths of thread engagement are also included.

Fine and Coarse Threads

When using a hand tap, a fine thread is, of course, more easily cut than one of coarse pitch, and where the tap has to be forced into the work the risk of breaking a slender tap is greatly increased. Threading with a standard Whitworth $\frac{1}{2}$ in. $\times$ 12 t.p.i. tap requires considerable effort even with a long-handled tap wrench, but a $\frac{1}{2}$ in. $\times$ 26 t.p.i. tap seems to cut quite freely and very little resistance is felt.

To ease the work of tapping, therefore, it is better to use the finer thread, as long as it is suitable for the job.

Taps having 40 threads to the inch remove very little metal but with slight resistance even when cutting to nearly the full depth of thread, so that a thread engagement of 95 per cent. or more can be allowed for when fixing the tapping size. For threading brass with the larger sizes of 26 t.p.i. taps, a depth of thread equal to 95 per cent. is commonly cut by using a tapping drill 3/64 in. less than the nominal diameter. If a gas-tight threaded joint is required, 100 per cent. depth of engagement should be aimed at, otherwise leakage may occur along a spiral path where the tips of the threads have clearance.

Although the deep threads of a coarse-pitch screw give a very strong hold, the deep threading tends to weaken the screw, and the remaining core may give way long before the threads become stripped by over-tightening. The holding power of a fine-pitch screw can, however, be increased by merely increasing the length of the threaded portion engaging in the work. For easy tapping in steel it is, therefore, best to avoid the standard Whitworth range, except the $\frac{1}{8}$ in. $\times$ 40 t.p.i. and smaller, and to use instead the B.A. sizes, or 40 thread taps for light work and the B.S.F. and 26 t.p.i. range for larger constructional work.

Aligning the Tap

If the tap is not entered squarely, not only will the workmanship be defective, but the tap will be harder to turn and will be more easily broken, particularly when attempting to straighten the tap in the hole. Whenever possible, therefore, make use of a component to guide the tap correctly in the work.

The accompanying drawing shows how this can be done when attaching one part to another by means of screws. After the parts have been securely clamped in position, the tapping-size hole is first drilled right through both components, and this is opened out with a drill of the same diameter as the nominal size of the tap. The drilling should be continued until the drill enters the lower component for a distance equal to about one and a half threads; this is to avoid setting up a burr that might keep the parts from seating correctly.

Now turn the work over and counter-drill the underside in the same way and for the same reason. When it comes to threading the holes, the tap will be automatically kept square with the work, and the support gained will also lessen the risk of breaking the tap.

Should the tapping hole in the work be blind, make sure that the depth of drilling is sufficient to give the tap ample end-clearance.

Keep the hole clear of chips to allow the tap to enter for the full distance, and so that the screws will enter freely when assembling the work.

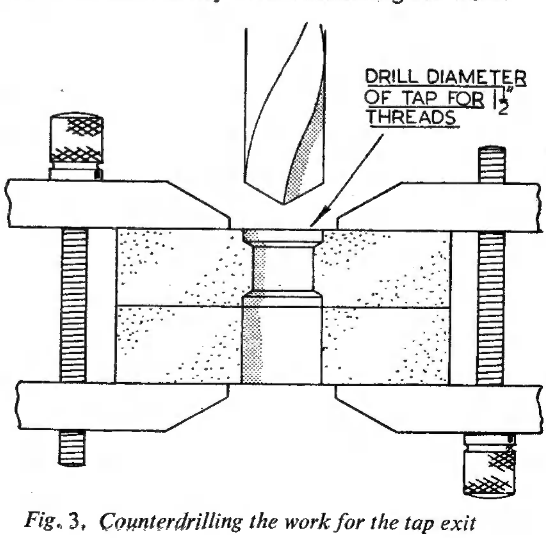


Fig. 3. Counterdrilling the work for the tap exit

PRACTICAL LETTERS

A Model Steam Pumping Plant

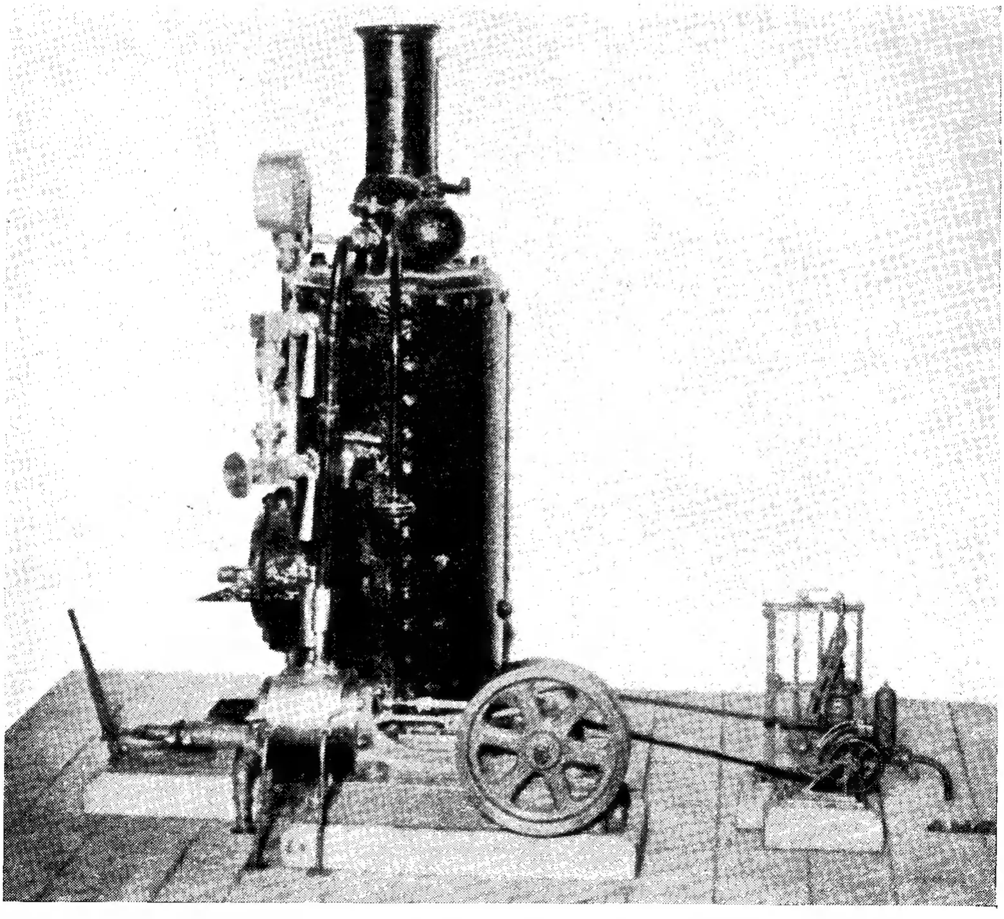
DEAR SIR,—As a reader of THE MODEL ENGINEER for a great many years, I cannot remember noticing any account of a steam pumping plant. I have constructed a model of one and thought your readers might be interested in a description of it.

The boiler was purchased from one of your advertisers several years ago; as near as I can remember it came from Sutcliffe of Leek, Staffs, and is still in good order. It is of the centre-flue vertical type as you will see by the photograph, and constructed of $\frac{1}{8}$-in. steel plate, 12 in. high and 5 in. diameter, fitted with pressure gauge, water gauge, and stop cock, the latter which I made myself. It still steams well on coal fuel.

The engine is a No. 8 Stuart horizontal which I built from a set of castings, and is fitted with drain cocks and a displacement lubricator, which I made myself. It drives a "Godwin" deep well or Borehole power working head, built to a scale of $\frac{1}{4}$ in. to the foot, ($4\frac{1}{2}$ in. high), and belt-driven from the engine through a small pulley. I constructed it entirely from scrap, with the exception of the gears, which I obtained from an old aeroplane several years ago.

The pump cylinder is a piece of brass tubing $\frac{1}{2}$ in. bore and $1\frac{1}{2}$ in. stroke, top and bottom caps screwed to take the rising main and suction pipes respectively. The plunger is fitted with two cup leathers. The delivery valve is of the stalk pattern and the suction valve is of the spear type, leather faced, with head screwed and pinned. The whole model was copied from a steam plant used to supply an estate, with Manor house, farms and village, before the introduction of modern power. It is housed in a model pump house of the Georgian style to match the Manor house. The plant delivers water through a $\frac{1}{8}$ in. bore pipe to a water tower, and delivers through mains to the various parts of the estate.

All the machining of plant was carried out on a Drummond $3\frac{1}{2}$-in. lathe which I purchased from an advertiser in THE MODEL ENGINEER



in 1905. It is still in good order and has had only one adjustment to the mandrel in all these years.

I may add that I am 75 years old and still occupy my spare time in model making, but cannot do any very accurate work, so now concentrate on pumps and wind-mills.

Yours faithfully,
Fairford. T. BROWN.

Steam Still in Vogue

DEAR SIR,—I was very interested in your recent "Smoke Ring," and have had the pleasure of sailing in and out of the dock, where both Messrs. C. D. Holmes, and Amos and Smith fit out the new trawlers. I have seen in this last few years, quite a considerable number of new steam trawlers in addition to the diesel-engined ones.

It may be a coincidence, but after a short time most of the diesel-engined jobs get sold abroad; with trawlers it is not just a matter of having a main (propulsion) engine, but a winch, and a good one at that; this must be just as reliable as the main engine, and as tough.

Here are a few rough notes upon the modern steam trawler: Scotch marine boiler, three furnaces, oil-burning, main engine at triple expansion, h.p. 1,200, a modern steam winch can be 500 h.p. When fishing, the boiler may be putting out up to 2,000 h.p.; these were figures given by a well-known superintendent.

Practically all boilers are superheated; a recent steam trawler last week, completed an easy 15 knots. I was in dock at the time, when one of the Liverpool tugs was manoeuvring out, and when the order astern was given, the torque resulting from the power was amazing, the tug heeling-over.

Now, for Mr. W. Boddy, I have seen recently, four traction-engines, and now another nine, awaiting shipment to Belgium for doing up and then to be *used there*; one a "Fowler" (Big Lion) had a 1950 license still on. Also, a weekly paper I sometimes take, *The World's Fair* often has some notes about traction-engines (showmen's). Being a marine engineer, I am equally at home on both steam and diesel, but have a greater leaning towards steam.

Yours faithfully,
Hull, Yorks. "KING COAL."

CLUB ANNOUNCEMENTS

Welling and District Model Engineers' Society

The Welling M.E.S. is holding a regatta for free-running boats only on Saturday, May 31st (Whit Saturday).

The first race is at 2 p.m. and there will be towing, steering, nomination and radio-control events.

In order that the society can provide tea will all those coming please let the secretary, J. A. King, know at least, by Wednesday preceding? Address: 309 Days Lane, Sidcup, Kent. (Telephone: Bexleyheath 5872.)

The regatta will be held at the Belvedere Recreation Ground, Woolwich Road, Belvedere, by the Eardly Arms. 99 buses from Woolwich and Erith; 401 and 486 from Dartford, Bexleyheath and Sevenoaks.

Radio-control experts are asked to use the lake before 1 p.m., if possible, for tuning purposes.

Aylesbury and District Society of Model Engineers

The April meeting was devoted to a talk by Mr. S. F. Stevens, who has been appointed to control our small scales department. Mr. Stevens told members of the plans he is making for an "O" gauge layout which is to form part of our stand at this year's Aylesbury Association Exhibition. The track is to be of the double continuous type, in a space of 12 ft. × 24 ft., and outside third rail has been decided on for electrical pick-up.

Hon. Secretary: E. H. SMITH, Mulberry Tree Cottage, Devonshire Avenue, Amersham, Bucks.

Vickers-Armstrongs Model Exhibition

The annual exhibition of the model section of Vickers-Armstrongs Ltd. (Weybridge) Social and Athletic Club will be held at Vickers Sports Ground, Kings Head Lane, Chertsey Road, Byfleet, on July 12th, 1952, at 2 p.m.

Entries, for the purpose of judging, will be grouped in six sections, e.g. aircraft, cars, general engineering, locomotives, power boats and sailing boats.

Closing date for entries July 9th, 1952.

Locomotive owners will have the track at their disposal which caters for 2½-in., 3½-in. and 5-in. gauge.

Hon. Secretary: C. LAWSON, 32, Dawson Road, Byfleet, Surrey.

Eltham and District Locomotive Society

The next meeting will be held at the Beehive Hotel, Eltham, on Thursday, June 5th, at 7.30 p.m., when Mr. May, a new member, will talk on his recently constructed 3½-in. gauge tank locomotive, *Eileen*. At a previous session Mr. May had brought along this locomotive, which was a beginner's first attempt, for the inspection of members, and was congratulated on a very creditable piece of work. At the last meeting our treasurer, Mr. Brock, brought along the chassis of his 3½-in. gauge L.N.E.R. locomotive, and gave a very interesting talk on the methods of construction and machining of the components. This chassis recently gained a first prize at an handicrafts exhibition held in London. The portable track will shortly be in use again for another busy season at outdoor fetes and sports days, and again members are specially asked for their support.

Visitors are cordially invited to the meetings.

Hon. Secretary: F. H. BRADFORD, 19, South Park Crescent, London, S.E.6.

Barry Miniature Railway Club

The club meets every Wednesday evening at 7.30 p.m., in our comfortable clubroom at the rear of Red Cross House, Newlands Street, Barry.

The large "O" gauge layout, now being fitted with automatic signalling, is still going strong, despite the continuous work it has to do.

Mr. C. Salmon kindly exhibited his nearly-finished free-lance model of a portable engine to the club three weeks ago. Everyone who saw it was amazed at its beautiful workmanship, particularly in the valve gear, and all agreed that it was a truly excellent model. We have since heard that the engine has passed its first steam trial with flying colours.

The chassis of Mr. H. Randall's 3½-in. gauge G.N.R. Atlantic locomotive has already been run on steam on the test bench and, after being "run in" for a short time, has shown great promise of being a very sturdy performer.

Besides the Atlantic there are also under construction the club's own 0-6-0 tank locomotive, *Butch*, in 5-in. gauge; two "King George V's," one G.W. 0-6-0 "Iris," and one "Juliet," all in 3½-in. gauge.

We are always keen to see new faces in the clubroom and anyone interested is welcome to send a postcard for further details to the Hon. Secretary, G. J. WATKINS, 6, Lowdon Terrace, Barry, Glam.

Salisbury and District Model Engineer Society

Our fourth model engineering exhibition will be held at the Market House, Salisbury, on Saturday, May 31st, and Whit Monday, June 2nd next, from 10 a.m. to 9 p.m. each day.

The exhibition will be opened by the Mayor of Salisbury and will be open for private viewing by the Press and other guests on Sunday afternoon.

It will be the biggest exhibition we have yet staged as it will cover some 10,000 sq. ft. Outstanding exhibits will be a fine 20-ton Fowler Lion showman's road locomotive formerly belonging to Anderton & Rowlands, of Bristol, and for the first time in Salisbury a miniature Grand Prix car racing track measuring 46 ft. × 22 ft. operated by Mr. F. R. Lee, of the Bath Mini-car Club and Mr. H. Adams, of Boscombe. On this track, which includes two straights, banked